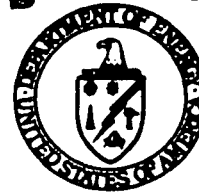




**Department of Energy**

**Ohio Field Office  
Fernald Area Office**

P. O. Box 538705  
Cincinnati, Ohio 45253-8705  
(513) 648-3155



DOE-1374-97

SEP 02 1997

Mr. James A. Saric, Remedial Project Manager  
U.S. Environmental Protection Agency  
Region V - SRF-5J  
77 West Jackson Boulevard  
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager  
Ohio Environmental Protection Agency  
401 East 5th Street  
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

**RESPONSES TO U.S. ENVIRONMENTAL PROTECTION AGENCY AND OHIO  
ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT AREA 2, PHASE I  
SITE PREPARATION PLAN**

- References:
- (1) Letter, DOE-1140-97, from J. W. Reising to J. Saric and T. Schneider, "Transmittal of the Site Preparation Plan for Area 2, Phase I - Inactive Flyash Pile, South Field, and Active Flyash Pile (Southern Waste Units)," dated June 13, 1997.
  - (2) Letter from J. Saric to J. W. Reising, "Area 2, Phase I Site Preparation Design Package," dated July 23, 1997.
  - (3) Letter from T. Schneider to J. W. Reising, "Comments - OU5 Area 2 Phase I Site Preparation Package," dated July 21, 1997.

The purpose of this letter is to transmit, for your review and approval, responses to comments received from both the U. S. Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OEPA) on the Site Preparation Plan documents for Area 2, Phase I, which were submitted to the EPAs on June 13, 1997 (Reference 1). The U.S. EPA comments on the Area 2, Phase I Site Preparation Plan documents were received on July 23, 1997, (Reference 2); whereas OEPA comments on the same documents were received on July 21, 1997, (Reference 3). In support of the Area 2, Phase I response-to-comments (RTC) document, this letter also transmits the following:

- (1) Evaluation of the potential peak stages in Paddy's Run during storm events at the cross-sections close to the proposed Retention Basin 1, and, a comparison of Brown & Root Environmental (B&RE) HEC-1 Model and Parsons TR-55 Model.
- (2) Cross-sections and plan view drawings through Inactive Flyash Pile (IFP) and Retention Basin 1 at Paddy's Run (Sketches 1, 2, and 3).
- (3) Earthwork calculations for Southern Waste Units.
- (4) Tables 1 - 4 from Sitewide Excavation Plan.
- (5) revised Site Preparation technical specifications.
- (6) revised Site Preparation construction drawings.
- (7) Revised Surface Water Management Plan.

Some of these deliverables have already been provided to you informally. They are provided here in order to ensure a complete package is obtained and to better facilitate your review. As you are aware, efforts are continuing to analyze and evaluate the field sampling data obtained through the Project Specific Plan (PSP) supporting the site preparation excavation activities. This PSP was the subject of discussions with both the U.S. EPA and the OEPA on the teleconference which took place on August 14, 1997. Additional pre-design information, namely in the identification of sub-areas or regions within Area 2, Phase I which potentially contain concentrations of contaminants which exceed Waste Acceptance Criteria (WAC), will be collected through the implementation of the second PSP for Area 2, Phase I, titled, "Delineation of Areas Exceeding WAC in Area 2, Phase I." The sampling activities (including their associated analytical results) for these two PSPs should be complete by the anticipated start of site preparation activities (September 14, 1997). As a result, site preparation-based (and the eventual waste unit-based excavations, which are scheduled to start in the spring of 1998) will be conducted in a manner ensuring that any WAC concerns are properly handled.

The Integrated Remedial Design Package (IRDP) for Area 2, Phase I, scheduled to be submitted to the U.S. EPA and OEPA by October 20, 1997, will include the following documentation:

- o Implementation Plan (Work Plan)
- o Surface Water Management Plan for waste materials excavations
- o Earthwork calculations for excavation of waste materials
- o Excavation Technical Specifications
- o Excavation Construction Drawings
- o Excavation Criteria Package

I hope the enclosed documentation concerning the Site Preparation activities in Area 2, Phase I satisfactorily answers your concerns. If you should have any questions or concerns,

please contact Robert Janke at (513) 648-3124. Finally, we are looking forward to further discussing these planned site preparation activities with you at our upcoming meeting on September 9, 1997.

Sincerely,



Johnny W. Reising  
Fernald Remedial  
Project Manager

FEMP:R.J. Janke

Enclosures: As Stated

cc w/enc:

N. Hallein, EM-42/CLOV  
G. Jablonowski, USEPA-V, 5HRE-8J  
R. Beaumier, TPSS/DERR, OEPA-Columbus  
M. Rochotte, OEPA-Columbus  
T. Schneider, OEPA-Dayton (total of 3 copies of enc.)  
F. Bell, ATSDR  
D. S. Ward, GeoTrans  
R. Vandegrift, ODOH  
R. Geiger, PRC  
M. Davis, ANL  
AR Coordinator/78

cc w/o enc:

D. Carr, FDF/52-5  
J. D. Chiou, FDF/52-5  
T. Hagen, FDF/65-2  
J. Harmon, FDF/90  
R. Heck, FDF/2  
EDC, FDF/52-7

1120

**Technical Specifications  
for  
Waste Units Remediation Project  
Southern Waste Units  
Site Preparation Package  
Subcontract No. FSC607**

**August 26, 1997  
Revision 2**

**Environmental Remedial Action Project  
Fernald Environmental Management Project  
Fernald, Ohio  
FDF Project No. 20400**



**25 Merchant Street  
Cincinnati, Ohio 45246**



**Technical Specifications  
for  
Waste Units Remediation Project  
Southern Waste Units  
Site Preparation Package  
Subcontract No. FSC607**

**WBS No. 1.1.1.1.2.3.6**

**August 26, 1997**

**Revision 2**

**Environmental Remedial Action Project  
Fernald Environmental Management Project  
Fernald, Ohio  
FDF Project No. 20400**



**PARSONS**

**25 Merchant Street  
Cincinnati, Ohio 45246**

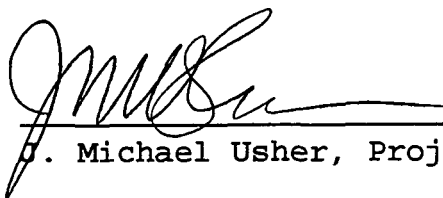
## U.S DEPARTMENT OF ENERGY

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Subcontract No. FSC607

WASTE UNITS REMEDIATION PROJECTSOUTHERN WASTE UNITSTECHNICAL SPECIFICATIONSPARSONS

Approved by:



J. Michael Usher, Project Manager

27 August 97

Date

U.S. DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
SUBCONTRACT NO. FSC607

WBS NO. 1.1.1.1.2.3.6  
TECHNICAL SPECIFICATIONS

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000002

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16500	LIGHTING	0	05/30/97
16855	HEATING CABLES	0	05/30/97

# Specification Revision Record Sheet

Project Order 165

Waste Units Remediation Project  
Southern Waste Units  
Site Preparation Package

Spec. No.	Description	RE Approval	Tech. Lead Approval	PM Approval	Date
01012 01450 02100 02200 02205 02225 02270 02506 02510 02713 02900 13125 13126	Incorporation of USEPA and OEPA comments provided per Design Change Notice (DCN) 20401-005 and FDF comments provided in DCNs 20401-001, 002, 003, 004, 006, 007, and 008.	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	8/27/97
Note: Shaded areas in specification indicate current revision (e.g., date)					

Date: 08/26/97  
Rev.: 2 RE: WM

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WBS No: 1.1.1.1.2.3.6  
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000003

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Subcontract No. FSC607

WASTE UNITS REMEDIATION PROJECT  
SOUTHERN WASTE UNITS  
TECHNICAL SPECIFICATIONS

Division 1

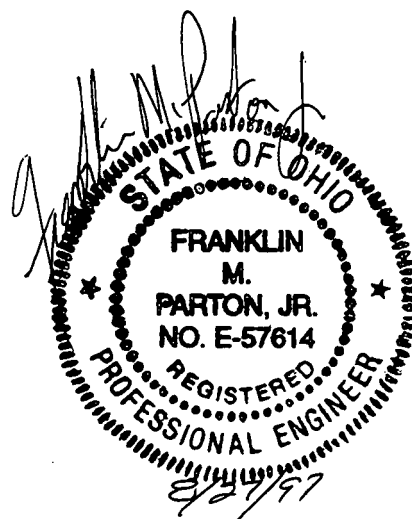
PARSONS

Prepared by:

Wayne Moore (by Steve Nelson) 8/27/97  
Franklin M. Parton, Jr. (01050, 01450) 8/27/97  
 Date

Checked by:

Kenneth F. Grand 8/27/97  
 Date



Date: 08/26/97  
 Rev.: 2 RE: WM

01000

WBS No: 1.1.1.1.2.3.6  
 SCEP/165/SWU/SITE

SECTION 01000  
GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

- A. This specification and accompanying construction documents describe all work for the site preparation phase of the Southern Waste Units (SWU) portion of the Waste Units Remediation Project (WURP). The SWUs consist of the Inactive Flyash Pile (IFP), South Field (SF), and the Active Flyash Pile (AFP). The site preparation phase includes, but is not limited to:
1. Tapping an existing water line in three locations and installation of three new drinking water lines.
  2. Installation and construction of erosion sediment control facilities including runon and runoff control ditches and silt fence and berm.
  3. Construction of three retention basins and installation of associated lift stations and double-walled transfer line.
  4. Clearing trees and brush and stump grinding.
  5. Surveying for construction layout and as-built drawings.
  6. Excavation, removal, and stockpiling of materials.
  7. Construction of a support area and installation of two trailers.
  8. Chipping trees and brush and stockpiling wood chips.
  9. Preparation of subgrade and placement of geomembrane liner in ditches, basins, and stockpile areas.
  10. Development, operation, and reclamation of a borrow area to provide clay material for lining three retention basins.
  11. Hauling (from the borrow area), placement, and compaction of the clay materials as a bottom liner in the three retention basins, followed by placement of an overlying geomembrane liner.



12. Removal/installation/relocation of chain link fencing, installation of construction fencing, and removal of plastic chain fencing.
13. Construction of a wheel wash facility.
14. Installation and extension of drainage pipes.
15. Installation of a new electric power line and associated electrical work for project facilities.
16. Operation and maintenance of constructed facilities until turnover to the excavation subcontractor.
17. Construction of stockpiles.
18. Relocating a rip-rap stockpile.
19. Preparation of a FDF approved Safe Work Plan for performing the site preparation work.
20. Geotechnical sampling and testing.
21. Dust control and associated FDF approved plan.
22. Placement and installation of dumped rock fill.
23. Relocation of gravel roadway (located west of Retention Basin #2).
24. Material tracking.
25. Installation of SFES discharge and treatment lines.

- B. In all cases where the words "Fluor Daniel Fernald, Incorporated" or "FDF" appear in these specifications, it shall be understood to refer to Fluor Daniel Fernald, Incorporated (FDF) Construction Manager.
- C. In all cases where the words "A/E Subcontractor" or "Engineer" appear in these specifications, it shall be understood to refer to PARSONS or to such other individuals or organizations acting within the scope of the specific duties entrusted to them.
- D. In all cases where the terms "Vendor" or "Seller" or "Manufacturer" or similar terms appear in these specifications or in the appendices to these specifications, they shall be understood to refer to an individual or firm(s) providing materials, equipment, or services.

- E. In all cases where the term "Subcontractor" appears in these specifications, it shall be understood to refer to the Site Preparation Construction Subcontractor.
- F. The Subcontractor shall provide written procedures for FDF's review and approval of all plans and tests to be performed as identified in the drawings and specifications. These procedures shall provide detailed step-by-step operations with sign-off columns and shall be submitted and approved prior to testing. Generally, all field test instruments shall have been calibrated, prior to use on this subcontract, by an independent calibration laboratory whose calibration equipment and instruments are fully traceable to National Institute of Science and Technology (NIST) standards. The Subcontractor shall maintain individual certification of calibration which evidences traceability to NIST standards for all field test instruments used on this subcontract.
- G. Work shall be accomplished in accordance with the following code requirements:
  - 1. Ohio Basic Building Code (OBBC) 1995.
  - 2. Uniform Building Code (UBC) 1994.
  - 3. Code for Safety to Life from Fire in Buildings and Structures (NFPA 101, Life Safety Code) - 1994.
  - 4. All other National Fire Protection Association (NFPA) Codes - All inclusive, including 1996 revisions.
  - 5. Occupational Safety and Health Administration (OSHA) - 29 CFR 1910 and 29 CFR 1926.
  - 6. FDF Lockout/Tagout Procedure OP-0004.
  - 7. Ohio Plumbing Code - 1993.

## 1.2 SITE AND SCOPE

- A. The intent of these specifications is to provide all technical information required and necessary to perform and complete the work as required by the Contract.
- B. The Subcontractor shall provide all labor, services, materials, and equipment, and shall do all work

necessary to accomplish this within the limits of work as defined in the accepted bid and Contract.

**1.3        LISTS OF MATERIALS, MANUFACTURERS, OR EQUIPMENT SUPPLIERS**

- A.        The listing of materials, equipment, manufacturers' names, or equipment suppliers in these specifications in no way precludes the offerer from proposing alternate materials, equipment, manufacturers' names, or equipment suppliers of any of the items to be furnished within the scope of these specifications, except where specifically precluded by these specifications. These lists are intended to identify the types and general quality of those items that will be included in the offerer's proposal. It is the offerer's responsibility to propose the materials, manufacturers' names, or equipment that is best suited for this project in combined terms of quality and price.

**1.4        SUBMITTALS - SHOP DRAWINGS, SAMPLES, AND OTHER DATA**

- A.        Section 01011 has the submittal listing. Refer to Part 6, Statement of Work and Part 7, technical specifications, and drawings for additional submittal requirements. The Subcontractor is responsible for providing all submittals required in the subcontract whether listed in Section 01011 or not. Any submittals not in conformance with these requirements will be returned without review for correction and resubmittal:
1. Safe Work Plan. The Safe Work Plan shall include general information and approach and will include specific documents described in the technical specifications.
  2. Assemble and submit, if required, in logically arranged folders, the following:

All instruction bulletins, diagrams, lubrication schedules, operating instructions, parts lists, and pamphlets for equipment and apparatus furnished, including vendor's or manufacturer's recommended

procedure for lifting, handling, and installing equipment.

3. Submittals for equipment shall include manufacturer's catalog "cut sheets" or similar information bulletins indicating the model number or catalog number, ratings, size, weight, and performance curves and data. Indicate operating point on curves and tabular data for each piece of equipment that curves or data represent.
4. Submit wiring diagrams or connection diagrams for equipment items, accompanied by adequately defined symbols list. Schematic and wiring diagrams must be prepared in accordance with ANSI/IEEE Publication Y32E, "Electrical and Electronics Graphics Symbols and Reference Designations." Individual 8-1/2 by 11-inch elementary and wiring drawings are not acceptable.
5. Indicate all performance data, construction material finishes, and modifications to manufacturer's standard design specified.
6. Locate termination points for all required external wiring.
7. Indicate roughing-in, foundation, and support point dimensions.
8. Submit written test procedures for all required testing. Include criteria for acceptable performance. Submit test reports after completion of tests.
9. Submit Material Safety Data Sheets (MSDSs), for all cutting oils, caulks, sealants, lubricants, paints, etc., and all other similar compounds.
10. The Engineer's review of such submittals shall not relieve the Subcontractor from any responsibility for deviations from contract drawings or specifications, unless the Subcontractor has in writing called FDF's attention to such deviations at the time of submission, nor shall it relieve the Subcontractor from responsibility for errors of any sort in the submittals nor from responsibility for the proper fitting and construction of the work.
11. Submittals will be reviewed with respect to such factors as quality of draftsmanship, legibility,

and evidence that the Subcontractor is aware of the necessity and importance of adequately detailing and illustrating special features and conditions relating to the work. Dimensions, sizes, construction details, and directive notes shown will be reviewed for accuracy, compliance with the specifications, adequacy, interferences, etc., on a spot check or incomplete basis to establish that the Subcontractor has given such factors careful attention.

12. Any changes marked on submittals during review will be for the purpose of indicating the requirements of the contract documents, and no change in the contract amount is authorized by such markings.
13. When submittals are found to be satisfactory with respect to the above factors and within the scope of the review outlined above, they will be returned by FDF to the Subcontractor bearing certificate attachment permitting the Subcontractor to employ them in the furtherance of the Subcontractor's work under the contract. The Subcontractor shall understand that such permission shall not relieve the Subcontractor of the responsibilities for the full performance of the work required under the contract in conformance with the contract documents governing such performance, nor for any other deficiencies in the submittals such as inaccuracies, discrepancies, omissions, interferences in the work itself, or with the work of other contractors, whether or not such deficiencies were observed or noted in the course of the review of the shop drawings.
14. The Subcontractor shall verify all field dimensions required for shop drawings.

## 1.5 REFERENCES

- A. The publications listed in the technical specifications form part of this specification. Each publication shall be the latest revision and addendum in effect at the time of issue of contract and of issue of the

specification unless notified otherwise. Except as modified herein or by the details of the drawings, work included in this specification shall conform to the applicable provisions of these publications.

#### 1.6 MANUALS AND SPARE PARTS LISTS

- A. Copies of manufacturers recommended spare parts list (including critical long-lead time spare parts) shall be submitted prior to the shipment of any item of equipment.
- B. A Systems Implementation Manual shall be prepared so as to provide optimum readiness of the equipment and systems being furnished. The Systems Implementation Manual shall be coordinated with the requirements as noted in the accompanying Systems Plan.
- C. The cover of the Systems Implementation Manual shall include the following information:
  - 1. Project Title - Waste Units Remediation Project Southern Waste Units Site Preparation Package
  - 2. WBS No. - 1.1.1.1.2.3.6
  - 3. Engineer - PARSONS
  - 4. Construction Manager - FDF
  - 5. Subcontractor Name.
- D. The Systems Implementation Manual shall be bound into one or more volumes for ease of handling and shall have an index. The manual shall include descriptive literature, drawings, performance curves and rating data, test reports, and spare parts lists. The maintenance section shall divide maintenance procedures into two categories, "Preventive Procedures" and "Corrective Procedures," and a subsection for "Safety Precautions." Preventive maintenance shall include cleaning and adjustment instructions. Corrective Maintenance shall include instructions and data arranged in the normal sequence of corrective maintenance (i.e., troubleshooting) (logical effect to cause), then repair and replacement of parts, then the parts list. Safety Precautions shall comprise a list of safety precautions and instructions to be followed

before, during, and after making repairs, adjustments, or routine maintenance.

- E. Submit complete sets of the final approved manual prior to the shipment of the equipment or system.

## 1.7 SPECIFICATION EXPLANATION

- A. General: The technical specifications are of the abbreviated, simplified, or streamlined type and include incomplete sentences. Omissions of words or phrases such as "the Subcontractor shall," "in conformity therewith," "shall be," "as noted on the drawings," "according to the plans," "a," "the," and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings.

The Subcontractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled either on the drawings, or specified herein, or both, including all labor, materials, equipment, and incidentals necessary and required for their completion and installation unless stated otherwise.

For convenience of reference and to facilitate the letting of contracts, the specifications may be separated into titled divisions. Such separations, however, shall not operate to make the Engineer an arbitrator to establish the limits of subcontracts in any manner. The following defines the separations referred to in the specifications.

1. Division: Separate numbered division of specifications (e.g., Div. 16)
2. Section: Separate numbered section of a division (e.g., Sec. 16020)
3. Article: Separate numbered article of a section (e.g., Article 2.1)

- B. Definitions: Certain terms and words as used throughout the specifications shall be defined as follows, unless otherwise particularly specified:

1. "Provide": Furnish and install, complete, in place.
2. "Indicated": As shown on the drawings and/or specified.
3. "Directed,"  
"Authorized,"  
"Permitted": Shall be as directed, authorized, or permitted by FDF.
4. "Selected": Shall be as selected by the Engineer or FDF.
5. "Satisfactory,"  
"Acceptable": Satisfactory or acceptable to FDF.
6. "Necessary,"  
"Required,"  
"Suitable": As necessary, required, or suitable for the intended purpose as determined by FDF.
7. "Submit": Submit to FDF unless otherwise specified

#### 1.8 ABBREVIATIONS FOR REFERENCED STANDARDS AND SPECIFICATIONS

- A. The following list denotes abbreviations used in these technical specifications:

<u>Abbreviation</u>	<u>Authority</u>
AASHTO	American Association of State Highway and Transportation Officials.
ACI	American Concrete Institute
ADC	Air Diffusion Council
AFP	Active Flyash Pile
AGC	Associated General Contractors of America
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
APA	American Plywood Association



<u>Abbreviation</u>	<u>Authority</u>
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CFR	Code of Federal Regulations
DHI	Door and Hardware Institute
FDF	Fluor Daniel Fernald, Incorporated
FGMA	Flat Glass Marketing Association
FM	Factory Mutual System
FRL	Final Remediation Level
GA	Gypsum Association
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IFP	Inactive Flyash Pile
IMIAC	International Masonry Industry All-Weather Council
MBMA	Metal Building Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Science and Technology

<u>Abbreviation</u>	<u>Authority</u>
NPCA	National Paint and Coatings Association
OBBC	Ohio Basic Building Code
ODOT	Ohio Department of Transportation
OSDF	On-Site Disposal Facility
PACM	Presumed Asbestos Containing Material
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PIV	Post Indicator Valve
PS	United States Department of Commerce, Voluntary Products Standards
SDI	Steel Deck Institute
SF	South Field
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Steel Structures Painting Council
SWU	Southern Waste Units
UL	Underwriters Laboratories, Inc.
WURP	Waste Units Remediation Project

END OF SECTION

SECTION 01011  
SUBMITTALS LISTING

- A. Submittal Requirements: Submittals required include drawings and/or data for all items listed below:
1. "AA" designates that these items are special requirements as defined in detail in the applicable technical specification section.
  2. "BB" designates that shop drawings are required.
  3. "CC" designates that catalog cuts are required.
  4. "DD" designates that Material Certificates are required.
  5. "EE" designates that Certificates of Conformance are required.
  6. "FF" designates that engineering calculations are required.
  7. "GG" designates that spare parts list is required.
  8. "HH" designates that Systems Implementation Manuals are required.
  9. "II" indicates that manufacturer's material safety data sheets (MSDSs) are required.
  10. "JJ" indicates that wiring diagrams for power, signal, and control wiring are required.
  11. "KK" indicates that tests, which are to be witnessed by FDF, are required.
  12. "LL" indicates that test reports are required.
  13. "NN" indicates to be included in the Safe Work Plan.
- B. See the accompanying sheets for submittal schedules.

END OF SECTION

**PARSONS**  
**ERA PROJECT**

**Section 01011**  
**Submittals Listing**

Material/Equipment/ Item/Description	Special Reqs AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng'g Calcs FF	Spare Parts GG	Systems Implem Manual HH	MSDS II	Wiring Diagram JJ	Witness Tests KK	Test Rpt LL	Samples MM	Safe Work Plan NN
SECTION 01000														
Safe Work Plan														X
SECTION 01050														
Surveyor Qualifications	X													
As-Built Record Drawings	X													
Surveying Field Notes	X													
SECTION 01450														
Material Documentation Work Plan	X					X								X
SECTION 02100														
Traffic Control Plan						X								X
Dust Control Plan				X					X					X
Site Clearing Work Plan														X
Monitoring/Extraction Well Protective Barrier	X													

Material/Equipment/ Item/Description	Special Reqs AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng'g Calcs FF	Spare Parts GG	Systems Implem Manual HH	MSDS II	Wiring Diagram JJ	Witness Tests KK	Test Rpt LL	Samples MM	Safe Work Plan NN
SECTION 02200														
Excavation Work Plan														X
Material Source/Test Data				X								X		
Construction QC Data											X	X		
Geotechnical Lab	X													
SECTION 02205														
Impacted Material Work Plan														X
Competent Persons Training Certificate (Asbestos and Rad Worker II)	X													
Material Source/Test Data				X							X	X		
Construction QC Data											X	X		
SECTION 02225														
Sheeting and Shoring Plan		X				X								X
Material Source/Test Data				X								X		
Construction QC Data											X	X		
SECTION 02270														
Silt Fence			X									X		
Dumped Rock Fill (Riprap)				X										
Geotextile Fabric			X		X									
Erosion Control Blanket			X		X									
QA/Program/Inspection														X

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Material/Equipment/ Item/Description	Special Reqs AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng'g Calcs FF	Spare Parts GG	Systems Implem Manual HH	MSDS II	Wiring Diagram JJ	Witness Tests KK	Test Rpt LL	Samples MM	Safe Work Plan NN
SECTION 02506														
Aggregate Source	X													
Aggregate				X							X	X		
Geotextile			X		X									
Material Testing Laboratory	X													
SECTION 02510														
Bituminous Aggregate				X					X					
Aggregate Base	X			X	X	X					X	X		
Tack Coating			X		X				X					
Prime Coating			X		X				X					
Joint Sealant			X		X				X					
SECTION 02667														
Pipe/Fittings/Valves/Accessories			X	X							X	X		
Pipe Joining Compounds			X		X				X					
Hydrostatic Test Report												X		
Performance Certificate					X									
Disinfection Report												X		
Bacteriological Report												X		
Verification of Personnel Experience	X													

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Material/Equipment/ Item/Description	Special Reqs AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng'g Calcs FF	Spare Parts GG	Systems Implem Manual HH	MSDS II	Wiring Diagram JJ	Witness Tests KK	Test Rpt LL	Samples MM	Safe Work Plan NN
SECTION 02668														
Pipe/Fittings/Valves/ Accessories			X	X							X	X		
Pipe Joining Compounds			X		X				X					
Hydrostatic Test Report												X		
HDPE Manholes		X									X	X		
Verification of Personnel Experience	X													
SECTION 02669														
Pipe/Fittings/Valves/Accessories			X	X							X	X		
Pipe Joining Compounds			X		X				X					
Hydrostatic Test Report												X		
Verification of Personnel Experience	X													
SECTION 02713														
Geomembrane Liner				X	X								X	
Geomembrane Liner Installation	X	X										X	X	
SECTION 02720														
Water Management Plan	X													X
Culvert Pipe- CMP			X											
Riser Assembly	X	X		X								X		

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Material/Equipment/ Item/Description	Special Reqs AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng'g Calcs FF	Spare Parts GG	Systems Implem Manual HH	MSDS II	Wiring Diagram JJ	Witness Tests KK	Test Rpt LL	Samples MM	Safe Work Plan NN
Inspection Reports											X	X		
Corrugated HDPE Pipe			X	X										
HDPE Pipe			X	X										
Construction QC Data											X	X		
SECTION 02831														
Products and Materials		X	X						X					
SECTION 02900														
Seed				X										
Mulch				X										
Plant Nutrients			X		X				X					
SECTION 02999														
Construction Fence			X	X										
Caution Signs		X												
Buoys			X	X										
SECTION 03001														
Concrete Mix/Supplier	X			X								X		
Channel Grating			X											
Oil/Water Separator			X											
Curing Compound			X						X					
Joint Sealer			X						X					

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Water Stops			X											
Placement Records (Concrete)	X													
Placement of Reinforcing		X												
SECTION 13125														
Shop Drawings		X	X											
Support Location Plan		X	X											
Wall and Roof System Dimensions and Construction Details		X	X											
Down Spout/Splash Block Locations		X	X											
Tie-Down Location Plan and Details		X	X											
Product Data- Mechanical Components		X	X					X		X		X		
Manufacturers Installation Instructions	X	X	X					X		X				
Connection of Fire and Evac Alarm to Site System										X	X	X		
SECTION 13126														
Support Location Plan		X	X											
Tie-Down Location Plan and Details		X	X											
Connection of Fire and Evac Alarm to Site System										X	X	X		

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SECTION 15060														
Product Data for Pipe Fittings, Valves, and Accessories		X	X		X			X			X	X		
Test Procedures	X													
Welding	X								X					
SECTION 15090														
Piping Supports/Anchors		X	X											
Welding	X								X					
SECTION 15160														
Product Data for Pumps	X	X	X		X		X	X		X		X		
SECTION 15170														
Motors			X		X					X		X		
SECTION 15250														
Product Data for Insulation Materials			X		X				X					
SECTION 16050														
Combination Magnetic Motor Starters			X		X					X				
Selector Switches			X		X									
Conduit Receptacles			X		X									

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Material/Equipment/ Item/Description	Special Reqs AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng'g Calcs FF	Spare Parts GG	Systems Implem Manual HH	MSDS II	Wiring Diagram JJ	Witness Tests KK	Test Rpt LL	Samples MM	Safe Work Plan NN
Wire and Cable			X		X									
Instrument Cable			X		X									
Nameplates			X		X									
Wire Markers			X		X									
Wireway and Aux. Cutters			X		X									
Splicing and Term. Components			X		X									
Boxes			X		X									
Cabinets			X		X									
Supporting Devices			X		X									
Underground Warning Tape			X		X									
Inspection and Testing											X	X		
SECTION 16118														
Conduit and Fittings			X		X									
Warning Tape			X		X									
SECTION 16121														
Medium Voltage Cable			X		X							X		
Cable Terminations			X		X							X		
SECTION 16170														
Grounding Electrodes and Conductors			X	X										

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Equipment Grounding Conductors			X	X										
Testing Equipment Certification	X													
Ground System Testing											X	X		
SECTION 16311														
15 kV Fused Switch		X	X		X			X		X		X		
Bus Connection Kit		X	X		X					X		X		
SECTION 16370														
Poles			X		X									
Crossarms		X	X		X									
Pole Hardware			X		X									
Insulators			X		X			X						
Line Conductors			X		X									
Arresters and Cut-Outs			X		X					X				
Pole Mtd. Disc. Switches		X	X		X			X		X				
Fuses			X		X			X						
Pole Mounted Transformers			X		X					X				
Anchors			X		X									
SECTION 16462														
Transformer/Panelboards		X	X		X		X	X		X	X	X		

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SECTION 16470														
Panelboards		X	X		X		X	X		X	X	X		
SECTION 16500														
Luminaires and Lampholders	X		X		X									
Ballasts			X		X									
Lamps	X		X		X									
Exit Signs			X		X									
Emergency Lighting Units			X		X									
Photoelectric Control			X		X									
SECTION 16855														
Heating Cable and Accessories		X	X		X							X		

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SECTION 01012  
SCHEDULE OF DRAWINGS

1.1 DRAWINGS

The following drawings are hereby made a part of this contract:

<u>Drawing Number</u>	<u>Sheet Number</u>	<u>Rev.</u>	<u>Drawing Title</u>
1.	92X-5900-X-00319	X0001	1 Project Title Sheet
2.	92X-5900-X-00320	X0002	2 Drawing Index
3.	92X-5900-X-00321	X0003	1 Legend and General Notes
4.	92X-5900-G-00350	G0001	1 Traffic Flow Plan
5.	92X-5900-G-00281	G0002	1 Master Site/Utility Plan
6.	92X-5900-G-00348	G0003	1 Existing Conditions Plan
7.	92X-5900-G-00400	G0004	1 Survey Information and Soil Stripping Plan
8.	92X-5900-G-00282	G0005	1 Site Plan
9.	92X-5900-G-00284	G0006	1 Site Plan- Support Area
10.	92X-5900-G-00283	G0007	1 Site Plan- Wheel Wash Area
11.	92X-5900-G-00390	G0008	1 Site Plan- Paddys Run Area
12.	92X-5900-G-00303	G0009	1 Enlargement- Retention Basin #1
13.	92X-5900-G-00371	G0010	1 Enlargement- Retention Basin #2
14.	92X-5900-G-00372	G0011	1 Enlargement- Retention Basin #3
15.	92X-5900-G-00311	G0012	1 Erosion and Sediment Control- Sheet 1 of 2
16.	92X-5900-G-00368	G0013	1 Erosion and Sediment Details- Sheet 2 of 2
17.	92X-5900-G-00304	G0014	1 Transfer Line- Plan and Profile- Sheet 1 of 3
18.	92X-5900-G-00305	G0015	1 Transfer Line- Plan and Profile- Sheet 2 of 3
19.	92X-5900-G-00306	G0016	1 Transfer Line- Plan and Profile- Sheet 3 of 3

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<u>Drawing Number</u>	<u>Sheet Number</u>	<u>Rev.</u>	<u>Drawing Title</u>
20.	92X-5900-G-00312	G0017	1 Wheel Wash Pad- Structural Details
21.	92X-5900-G-00310	G0018	1 Wheel Wash Sump Discharge- Profile and Details
22.	92X-5900-G-00307	G0019	1 Water Line Details
23.	92X-5900-G-00309	G0020	0 Miscellaneous Details- Sheet 1 of 2
24.	92X-5900-G-00308	G0021	0 Miscellaneous Details- Sheet 2 of 2
25.	92X-5900-G-00411	G0022	1 Material Documentation Plan
26.	92X-5900-G-00452	G0023	0 Miscellaneous Details- Sheet 3 of 3
27.	92X-5900-G-00453	G0024	1 Site Plan - Borrow Area VOID Drawing
28.	92X-5900-N-00295	N0001	0 Piping and Instrumentation Diagram- Symbols and Legend
29.	92X-5900-N-00290	N0002	0 Piping and Instrumentation Diagram- Wastewater Collection and Transfer
30.	92X-5900-N-00291	N0003	1 Piping and Instrumentation Diagram- Drinking Water System Symbols and Legend
31.	92X-5900-E-00405	E0001	0 Single Line Diagram - West Side 13.2 kV Feeders
32.	92X-5900-E-00404	E0002	1 Single Line Diagrams / Elevations - Lift Station No's. 1,2 & 3
33.	92X-5900-E-00377	E0003	1 Single Line Diagrams / Elevations - Wheel Wash Facility & Support Area
34.	92X-5900-E-00378	E0004	0 Overall Site Power Plan
35.	92X-5900-E-00379	E0005	1 Panel Schedules
36.	92X-5900-E-00381	E0006	0 Elementary Diagrams
37.	92X-5900-E-00380	E0007	1 Cable and Conduit Schedules
38.	92X-5900-E-00406	E0008	1 Details - Sheet 1
39.	92X-5900-E-00382	E0009	1

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<u>Drawing Number</u>	<u>Sheet Number</u>	<u>Rev.</u>	<u>Drawing Title</u>	
40.	92X-5900-E-00407	E0010	1	Details - Sheet 2
41.	92X-5900-E-00408	E0011	1	Details - Sheet 3
42.	92X-5900-E-00409	E0012	1	Details - Sheet 4
43.	92X-5900-E-00376	E0013	1	Details - Sheet 5
44.	92X-5900-E-00454	E0014	0	Details - Sheet 6

END OF SECTION

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SECTION 01050  
SURVEYING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Survey.
- B. Submittals.
- C. Project record documents.

**1.2 QUALITY ASSURANCE**

- A. Employ a Land Surveyor registered in the State of Ohio to oversee and certify survey work as required of this section.
- B. Survey work shall be under the direct supervision of a person with at least 5 years of experience in construction surveying.
- C. Submit the Ohio Registered Land Surveyor's name, license number, and qualifications/experience of the person who will be supervising the actual field work within 15 days from the Notice to Proceed. Approval must be granted from FDF prior to starting survey work.

**1.3 SUBMITTALS FOR REVIEW**

- A. Provide submittals as required by Section 01011 and by Part 6 of the Contract Documents.
- B. Submit Surveyor qualifications to FDF and receive approval before starting survey work.
- C. On request, submit documentation verifying accuracy of survey work.
- D. Submit scaleable copies of completed as-built site drawings and certificate signed and sealed by the Land

Surveyor. As a minimum, surveys shall be performed and submitted within 15 days at the following intervals:

1. Prior to commencement of work.
2. At completion of retention basin excavation, prior to placement of infiltration barrier.
3. At completion of placement of infiltration barrier in retention basins.
4. At completion of construction work. This shall also include ~~topographical data of the borrow area, impacted material stockpile and non-impacted material stockpile.~~

- E. Drawings are to follow format and symbology as furnished by FDF in Intergraph Microstation files. Surveyor is to furnish scaleable hard copy as well as electronic files of completed survey drawings.
- F. Submit copy of all field notes. Field notes shall be legibly recorded on standardized field note forms. Notation shall be consistently applied to all project survey work; the stake marking format and the field book notation shall be compatible.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.
- B. Maintain an accurate and current set of red-line drawings with as-built locations. Data shall be incorporated within one week of construction.

#### 1.5 EXAMINATION

- A. Verify locations of survey control points prior to starting work. Identify control used on submittals.
- B. Promptly notify FDF of any discrepancies discovered.

#### 1.6 SURVEY REFERENCE POINTS

- A. Locate and protect survey control and reference points as shown on the construction drawings.

- B. Control datum for survey is established by FDF, as indicated on construction drawings.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Damaged or destroyed survey monuments shall be reestablished by FDF at Subcontractor's expense.

### 1.7 SURVEY REQUIREMENTS

- A. All survey shall be performed to Class 3 standards and specification of ACSM (American Congress on Surveying and Mapping) as defined below. Elevation shall be referenced to NGVD of 1929 and horizontal coordinate to NAD 1983.

Position Closure	1:5,000
Angles Accurate to	14 sec.
Distance Accurate to	0.007 ft.
(per 100 feet)	(1:15,000)
Rejection limit or spreads	
between D & R and sets	10 sec.
Number of positions or sets	
1" Instrument	2 Pos.
10" Instrument	1 Set 2DR
20" Instrument	1 Set 4DR
30" Instrument	1 Set 6DR
1' Instrument	1 Set 8DR
Azimuth Closure	30" N <sup>1</sup>
Azimuth Closure per	
angle point	10 Sec.
Number of Repetitions	
(distance measurements)	1
Taping Criteria <sup>2</sup>	
Temperature	Accurate to +6° F
Tension	Accurate to +3# of standard
Calibration	**
Type of Target	Plumb Bob String or Fixed

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1. N = Number of angle stations carrying azimuth. The smallest value for the azimuth closure criteria will apply.
2. Properly calibrated electronic distance measuring equipment may be used in place of metal tapes.
- Standardized tape or one calibrated with a standardized tape.

B. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. All proposed utilities including underground and overhead shall be shown with coordinates. Utilities shall include spot elevations at 100 ft intervals and location data including curve data. Surface features (i.e., manholes, PIVs, lift stations, utility poles) are to be included.
2. All proposed roadways, parking, and gravel areas shall be identified. The principal points of definitions shall be shown including road intersections, centerline, and curve information. Pavement width, culverts, other surface features shall be shown from point of definition.
3. Topographic contours shall be shown to nearest foot. Field run data shall be taken to adjacent existing undisturbed area (100 ft minimum) to create a smooth contour transition.
4. Structures (i.e., wheel wash facility, trailers) shall be located by a minimum of two coordinates and outside dimensions.

C. Perform surveys to determine quantities for partial payment.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

**END OF SECTION**

SECTION 01450  
MATERIAL DOCUMENTATION

**PART 1 GENERAL**

**1.1 SCOPE**

- A. This section presents material documentation requirements. The subcontractor shall document (monitor, record, and report) movement of all impacted and non-impacted material moved between Material Tracking Locations (MTLs) and Grids in the SWUs as described herein. Material documentation shall include the type, quantity, and location of all material moved in the SWUs. This documentation is only required for materials moving into or out of the MTLs or Grids. Materials handled but retained in a given MTL or Grid are not included.

**1.2 RELATED SECTIONS**

- A. Section 01050 - Surveying.
- B. Section 02200 - Non Impacted Material Earthwork.
- C. Section 02205 - Impacted Material Excavation and Handling.
- D. Section 02225 - Trenching.
- E. Section 02270 - Erosion and Sediment Control.

**1.3 REFERENCE DRAWING**

- A. Drawing Index No. 92X-5900-G00411 (Sheet No. G0022)  
Civil - Material Documentation Plan.

**1.4 TERMINOLOGY**

- A. Material Tracking Locations - The specific areas identified in this specification and as shown on the Civil - Material Documentation Plan (Sheet No. G0022)

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delineate select geographic areas in the SWUs. MTLs include:

1. Impacted Material Stockpile.
2. Non Impacted Material Stockpile #1.
3. Non Impacted Material Stockpile #2.
4. Retention Basin #1.
5. Retention Basin #2.
6. Retention Basin #3.
7. North Area.
8. Support Area.
9. Wheel Wash Area.
10. Ditch 1.
11. Ditch 2.
12. AFP Ditches.
13. Non Impacted Material Stockpile Ditches.
14. Ditch 8.
15. OSDF Designated Borrow Area.

- B. Grids are identified 200 ft by 200 ft areas in the SWUs. Grids correspond to areas that will be used to document material not contained within MTLs. An example Grid is L12-42 as shown on the Material Documentation Plan (Sheet No. G0022).

## 1.5 SUBMITTALS

- A. Submit for approval a Material Documentation Work Plan as part of the safe work plan which describes the detailed procedures that will be used to implement this specification.

## 1.6 QUALITY

- A. Material documentation reports shall be provided to FDF at the end of each working day. Quantities shall be estimated to the nearest 10 cubic yards for material moved into or out of each MTL or Grid during that day.

## 2.0 PRODUCTS

Not Used

### 3.0 EXECUTION

- A. Provide all personnel and equipment to document material movement as described herein.

### 3.1 PREPARATION

- A. Field stake and/or adequately delineate all MTLs and Grids in the field.
- B. Subcontractor shall educate and familiarize all appropriate competent personnel (minimum of 3) with the material documentation requirements.

### 3.2 REPORTING REQUIREMENTS

Report type, quantity and location of all material moved into or out of all MTLs and/or Grids on a daily basis.

- A. Describe type of material, based on visual observation in accordance with the criteria presented in Sections 02200, 02205, 02225, and herein. Present a general description such as "soil and soil-like material (including flyash, gravel, etc.)", "debris", "mixed", or "special material".
  - 1. Examples of general descriptions of mixed material include:
    - a. 10 percent concrete debris/90 percent soil.
    - b. 25 percent ground wood stumps/75 percent soil.
  - 2. Special material will include atypical items such as buried drums or other unusual items.
- B. Estimate quantities of material by volume moved based on visual observations. Use number of trucks/haul vehicles and their capacity and estimate volumes in approximate cubic yards.
- C. Report material movement to and from each MTL and/or Grid worked in each day. Use MTLs to the extent possible. Use Grid if no MTL is available.

### 3.3 PROCEDURES

- A. Comply with detailed procedures contained in subcontractors approved Material Documentation Work Plan.
- B. Provide a written summary of material documentation to FDF field personnel every day that material is moved.
- C. Material transported to any location shall use a IIMS Transfer Paper for documentation purposes, included in Part 4 of the Contract Documents, Exhibit 1A.
- D. FDF may spot check and work with Subcontractor to assist with implementation of this specification.

END OF SECTION



## U.S DEPARTMENT OF ENERGY

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Subcontract No. FSC607

WASTE UNITS REMEDIATION PROJECTSOUTHERN WASTE UNITSTECHNICAL SPECIFICATIONS

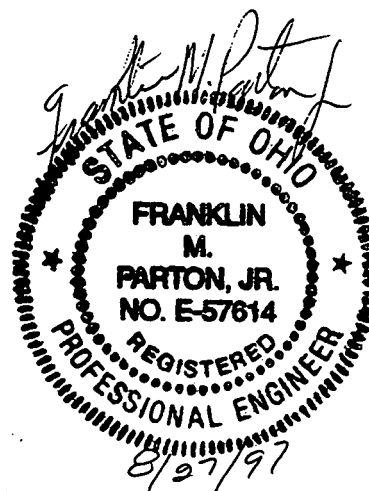
Division 2

PARSONS

Prepared by:

*Franklin M. Parton Jr.*8/27/97  
Date

Checked by:

*William L. Gonder*8/27/97  
DateDate: 08/26/97  
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SECTION 02100  
SITE PREPARATION

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Clearing and chipping.
- B. Traffic Control.
- C. Removal of fencing.
- D. Installation of fencing.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 01050 - Surveying.
- D. Section 02200 - Non-impacted Material Earthwork.
- E. Section 02205 - Impacted Material Excavation and Transportation.
- F. Section 02270 - Erosion and Sediment Control.
- G. Section 02720 - Site Drainage and Water Management.
- H. Section 02831 - Chain Link Fences.
- I. Section 02999 - Miscellaneous and Specialty Items

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

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#### 1.4 REFERENCES

- A. State of Ohio, Department of Transportation (ODOT): Construction and Material Specifications, January 1, 1997. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

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#### 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011 and by Part 6 of the Contract Documents.
- B. Submit a Traffic Control Plan to be approved by FDF prior to any site clearing or earth-moving operations. The plan should include as a minimum; planned traffic routes, planned crossings of major utilities (i.e., gas line, drinking water line, and groundwater line), and a plan to protect the existing utilities at the crossings. The crossing protection at a minimum should be a one-inch thick steel plate (length and width sized to accommodate the trenches and equipment to be used) or an equivalent alternative. Provide calculations for all crossing protection and all alternatives to the one-inch thick steel plate.
- C. Submit a Dust Suppression Plan in accordance with Part 6 of the Contract Documents prior to initiating site clearing or earthmoving operations. The Dust Suppression Plan shall be approved by FDF prior to any site clearing or earth-moving operations. Along with the plan, the manufacturer's Material Safety Data Sheets' (MSDS) recommendations for material handling and usage for any applicable proposed dust suppressant agents or crusting agents along with the MSDS, shall be submitted. FDF approval is required prior to application of any dust suppressant agent or crusting agent.

- D. Submit a site clearing work plan to be approved by FDF prior to initiating site clearing operations. The plan shall describe equipment, safety procedures, scheduling, personnel protective equipment, tree handling and transportation, and prevention of cross contamination.
- E. Monitoring/extraction well protective barrier detail.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Dust suppression materials shall be nonhazardous and biodegradable. Water shall be potable.
- B. Crusting agent shall be Pine Sap Emulsion by Cousins Dust Control Environmental Services or an approved equivalent.
- C. Materials for traffic control.
- D. Materials for monitoring/extraction well protective barrier.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Verify that existing utilities in the work area and all monitoring/extraction wells designated to remain are staked, flagged, and identified.
- B. Install an approved protective barrier around existing monitoring wells and extraction wells designated to remain as indicated on the construction drawings. If excavation is to occur in proximity to monitoring wells and/or extraction wells designated to remain, hand excavate the area within the protective barrier. If damage to existing monitoring wells occurs, all repairs will be completed by FDF at the Subcontractor's expense.

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- C. Verify that all utilities to be removed, or tapped to, have been properly isolated and drained (valve turned closed and locked) prior to commencement of work. FDF is to properly isolate and/or drain utilities (to empty pipe) that are to be abandoned or connected to, unless hot tap is specified on construction drawings.
- D. Install perimeter erosion and sediment control measures prior to any major grading activities in accordance with Section 02270.
- E. Notify FDF 2 days prior to need for required permits. Provide specific information necessary for permit application. FDF is responsible for obtaining all FEMP permits.

### 3.2 Clearing and Chipping

- A. Clear all trees and brush in accordance with this specification within the limits of work except as noted on the construction drawings.
- B. All trees and other vegetation shall be cut a foot above grade and handled as a clean material, chipped, shredded, and placed in the Wood Chip Stockpile as shown on the construction drawings. Minimize contact with ground to prevent contamination of fallen trees. The stockpile is to be turned over as necessary to prevent combustion.
- C. During site clearing and earthmoving operations, fugitive emissions, principally dust, shall be controlled using water misting/spraying techniques and/or dust suppressant agent as described in Part 6 of the Contract Documents. Water is not to be used for misting/dust suppression directly from hydrant. Water from hydrant for misting is to be a supply only. The subcontractor is to provide for means of pressure and spraying.
- D. During site clearing and earth-moving operations use a crusting agent on any disturbed flyash material to minimize dust and/or erosion.

### 3.3 REMOVAL OF FENCING

Remove existing yellow plastic chain, tee posts and signs at perimeter of SWUs and turn over to FDF.

### 3.4 INSTALLATION OF FENCING

- A. Install chain link fence and gates at locations indicated on the construction drawings and in accordance with Section 02831.
- B. Install construction fence in accordance with Section 02999 and at the locations indicated on the construction drawings. Construction fence shall be field located.
- C. FDF will delineate with fencing the Lead Contaminated Soil Area, and the Above WAC Excavation Area, and the potential above WAC areas (SWU-1 through SWU-4). Comply with all training requirements and site controls when working in the Above WAC Excavation Area. The subcontractor is prohibited from working in the Lead Contaminated Soil Area and above WAC Excavation Area.

### 3.5 PROTECTION

- A. Verify and protect from damage all utilities, monitoring wells, extraction wells, structures, survey monuments, and survey control points that remain (shown on the construction drawings). If the subcontractor damages existing monitoring well, extraction wells, structures, and/or survey monuments, repairs will be completed by FDF at the subcontractor's expense.
- B. Maintain existing roadways at the construction site and provide dust suppression as per the approved dust suppression plan.

END OF SECTION

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SECTION 02200  
NON IMPACTED MATERIAL EARTHWORK

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

This specification section describes excavation and placement of all non impacted material necessary to complete the site preparation phase of the Southern Waste Units (SWUs) Project. Impacted material is addressed in Section 02205. It shall include all associated geotechnical testing. The work to be performed in accordance with this section shall include, but is not limited to the following:

- A. Erosion and sediment control facilities.
- B. General grading for roads.
- C. Other facilities constructed from non-impacted material, as shown on the construction drawings and as required to perform the work.
- D. Borrow area development.
- E. Infiltration Barrier placement.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 01050 - Surveying.
- D. Section 02100 - Site Preparation.
- E. Section 02205 - Impacted Material Excavation and Handling.
- F. Section 02270 - Erosion and Sediment Control.

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G. Section 02506 - Aggregate Surface.

H. Section 02713 - Geomembrane Liner.

I. Section 02720 - Site Drainage and Water Management.

J. Section 02900 - Soil Preparation and Seeding.

### 1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

### 1.4 REFERENCES

A. State of Ohio, Department of Transportation (ODOT):  
Construction and Material Specifications, January 1,  
1997. Except as supplemented or otherwise modified  
herein and/or shown on the construction drawings, the  
entire work under this section shall be in compliance  
with the provisions of ODOT.

B. American Society for Testing and Materials (ASTM):

1. ASTM D698-91 Test Method for Laboratory  
Compaction Characteristics of Soil  
Using Standard Effort (12,400 ft-  
lbf/ft<sup>3</sup> [600 kN-m/m]).
2. ASTM D2216-92 Test Method for Laboratory  
Determination of Water (Moisture)  
Content of Soil and Rock.
3. ASTM D2487-93 Standard Classification of Soils  
for Engineering Purposes (Unified  
Soil Classification System).
4. ASTM D2922-91 Standard Test Methods for Density  
of Soil and Soil-Aggregate in Place  
by Nuclear Methods (Shallow Depth).
5. ASTM D3017-88 Standard Test Method for Water  
Content of Soil and Rock in Place  
by Nuclear Methods (Shallow Depth)  
(R 1993).
6. ASTM D4643-93 Test Method for Determination of  
Water (Moisture) Content of Soil by  
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## 1.5 SUBMITTALS

Provide the following submittals as required in Section 01011 and Part 6 of the Contract Documents.

A. Excavation Work Plan will be a part of the Safe Work Plan: The Excavation Work Plan will address both impacted and non-impacted material and shall address the following:

1. List of equipment to be used.
2. Methods for water management and equipment to be used (if any).
3. Sequencing and construction of stockpiles shown on the construction drawings.
4. Method of coordination of survey work with construction.
5. Schedule of excavation activities showing sequencing, production, and time.
6. Plan for controlling fugitive emissions during construction activities.
7. Identifying, moving, and placing Presumed Asbestos Containing Material (PACM).
8. Working in Contamination Areas using Radiological Worker II trained personnel.
9. Material Tracking Procedures.
10. Method and technique to prevent cross contamination of stockpiles.
11. Borrow Area ~~Development~~ and Hauling Plan.
12. Infiltration Barrier Placement Plan.

B. Qualification Summary of Independent Off-Site Geotechnical Laboratory: Submit a summary of qualifications meeting the license requirements Part 8.B.2.4.3.2 of the Contract Documents for an independent off-site geotechnical laboratory for approval by FDF. The laboratory must be approved by FDF before earthwork activities can begin. A qualification summary is not required for on-site laboratory.

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- C. On-site Material Sources: To the extent possible, use on-site material for required fill. Submit, as a part of the excavation work plan, a plan to use/reuse on-site material to perform the work.
- D. Off-site Material Sources: Submit name of off-site material suppliers and detailed descriptions of proposed material. All sources and proposed material must be approved by FDF. Change of source requires approval by FDF.
- E. Geotechnical Test Results: Submit results of all geotechnical tests by the approved independent geotechnical lab including:
  - 1. Standard Proctor moisture density tests.
  - 2. Sieve analysis.
  - 3. Density tests.
  - 4. Proctor curves for each type material used for approval by FDF prior to use.

#### 1.6 QUALITY ASSURANCE PROGRAM

- A. Survey Verification and Layout: Verify the existing utilities, topography, and drainage features shown on the construction drawings and inform FDF of any differences or conflicts with proposed work. Stake the locations of all earthwork in the field and review all proposed work with FDF in the field. Assure that all work is laid out and built in accordance with the requirements on the construction drawings and these specifications. Survey work shall be performed under the direction of a professional licensed surveyor in accordance with Section 01050 - Surveying.
- B. Independent Geotechnical Laboratory: Arrange and pay for the services of a qualified, independent geotechnical testing laboratory. The qualifications of the laboratory, meeting Part 8 of the Contract Documents, must be submitted to FDF and approved in writing prior to initiating excavation activities. The laboratory must provide documentation of compliance with this specification.

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## PART 2 PRODUCTS

### 2.1 MATERIALS

Non-impacted Material consists of non-fill material and any material which is not contaminated by previous FEMP practices. This material includes, but is not limited to soil and debris. To the extent practical on-site materials shall be used. Use of any off-site material must be approved in writing by FDF prior to bringing any material onto the FEMP site. The types of non-impacted material addressed by this section shall include:

- A. **Unclassified Material:** For the purposes of this project, unclassified material is defined as soil removed from a trench prior to the placement of pipe. The removed soil (unclassified material) will be placed back into the trench following the pipe placement. When the pipe is removed from service and physically excavated, the soils from the trench will be characterized as impacted or non-impacted.
- B. **General Excavation/Fill Material:** This material shall include all excavation (below any impacted material), soil stockpile, and all earthwork not otherwise certified by FDF as below FRLs.
- C. **Coarse Aggregate:** Conforming to ODOT Item 304 - Aggregate Base as modified herein. No slag materials will be allowed for use on site. Aggregate shall be crushed carbonate, crushed gravel, or other types of suitable materials. ~~meeting the following gradation requirements:~~
- D. **Infiltration Barrier:** Clay and clay like soil material obtained from the designated OSDF borrow-area Sediment Basin Stockpile with a maximum rock size of 3 inches in any direction.

### 2.2 Other Materials

- A. **HDPE Geomembrane Liner** per Section 02713.

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END

- A. Contact between and/or mixing of impacted material and non-impacted material shall be prevented. Material that is commingled with impacted material shall be designated as impacted material and managed in accordance with Section 02205 at no additional cost to FDF. Equipment and materials used in impacted material areas shall be kept separate from other equipment and materials until it is approved for release by FDF in accordance with Part 4 of the Contract Documents.

### 3.1 PREPARATION

- A. Establish site boundaries and access controls.
- B. Survey and layout all earthwork in accordance with Section 01050 - Surveying.
- C. FDF will flag existing utilities in the field. Maintain markings as described in Section 02100.
- D. Notify FDF when the actual conditions differ in any manner from those specified in the contract documents, or when soft or spongy areas or other unusual soil conditions are encountered.
- E. Install appropriate erosion and sediment control measures in accordance with Section 02270 and as indicated on the construction drawings.
- F. Clear areas in accordance with Section 02100.
- G. Dewater excavations as required.

### 3.2 PROTECTION

- A. Prevent surface water runoff from entering into excavation or to adjacent properties.
- B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- C. Protect bottom of excavations and soil adjacent to and

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beneath foundation from freezing.

- D. Reshape and recompact fills subjected to vehicular traffic to final grade and to compaction requirements.
- E. Protect finished work and existing features which will remain.
- F. Seed and mulch in accordance with Section 02900.
- G. Protect existing groundwater monitoring wells and extraction wells ~~in the area and~~ in the vicinity of the work area.
- H. FDF will identify and delineate the areas with above WAC material and lead contaminated soil. Prevent traffic and potential cross-contamination in these areas.

### 3.3 GENERAL EXCAVATION

- A. Classification of excavation material (impacted or non-impacted) and subsequent disposition shall be as indicated on the construction drawings. Any deviations from the construction drawings shall be determined and approved by FDF.
- B. Excavate non-impacted material to the lines and grades indicated on the construction drawings.
- C. Perform grading and other operations to maintain site drainage. Accumulated water shall be removed promptly. No material shall be placed in standing water or on spongy soils. Water is to be handled in accordance with the water management component of the Safe Work Plan. See Section 02720 for water management requirements.

### 3.4 FILLING AND EMBANKMENT

- A. Prepare subgrade as follows:
  - 1. Compact exposed subgrade to density requirements for subsequent fill materials. When existing ground surface has a density of less than the

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density specified, break up the ground surface, pulverize, adjust moisture content to specified limits, and compact to specified density.

2. Cut out soft areas of subgrade not capable of in situ compaction. Fill with unclassified borrow material and compact to density equal to or greater than requirements for subsequent fill material.

- B. Do not fill over porous, wet, frozen, spongy, or other unsatisfactory subgrade surfaces. Where unsatisfactory subsurface conditions in an area of fill are observed, excavate unsatisfactory material to satisfactory subgrade as approved by FDF.
- C. Fill areas to contours and elevations shown. Place and compact fill materials in continuous level layers not exceeding 6 inches compacted depth. Do not use frozen or saturated materials.
- D. Slope grade away from pads at a minimum 1/4-inch per foot, unless noted otherwise.
- E. Dust Suppression: See Section 02100 and Part 6 of the Contract Documents.
- F. Stockpile non impacted soil from the three retention basins in the non impacted material stockpile areas as indicated on the construction drawings. Non impacted material shall be placed on the non impacted material stockpile in lifts no more than 12 inches thick and compacted with two passes of a tamping foot or mesh/grid foot roller or equivalent. Maximum height of the stockpile shall be 20 feet with maximum side slopes of 2H:1V. Non-impacted material shall be segregated by point of origin.

### 3.5 COMPACTION

- A. The minimum density requirements shall be 95 percent of Standard Proctor Maximum Dry Density. Maintain optimum moisture content within  $\pm 4$  percent of fill materials

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except stockpiles to attain required compaction or as otherwise required for effective dust suppression.

### 3.6 FINISH OPERATIONS

- A. Grading and Tolerances: Grading shall be performed within 0 to +0.5 feet of the grades shown on the construction drawings.
- B. House Keeping: Leave the area in a clean and neat condition. Grade and stabilize site surface to prevent free standing surface water.
- C. ~~Seed all disturbed areas in accordance with Section 02900.~~ Surface controls (crusting agents, e.g., pine sap emulsion, shall be applied to and maintained on non-impacted stockpiles to minimize erosion.
- D. ~~Seed all disturbed areas not associated with the non-impacted stockpiled material in accordance with Section 02900.~~

### 3.7 BORROW AREA

- A. ~~Install erosion and sediment control structures.~~ Existing OSDF Sedimentation Basin Stockpile was placed with two materials separated by a geotextile; only borrow material above the geotextile.
- B. ~~Excavate material to provide positive drainage to erosion and sediment control structures.~~
- C. ~~After completion of borrow operation, seed and mulch in accordance with Section 02900.~~

### 3.8 INFILTRATION BARRIER

- A. Place infiltration barrier material in 8-inch loose lifts to obtain a total compacted thickness of 1-foot minimum.

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- B. The minimum density requirements of the infiltration barrier shall be 95 percent of Standard Proctor Dry Density. Maintain moisture content between -1 and +2 percent of optimum to attain required compaction.
- C. Roll Infiltration Barrier with steel smooth drum roller prior to geomembrane placement.

### 3.9 FIELD QUALITY CONTROL

- A. In-place density testing will be performed in accordance with ASTM D2922. Nuclear density gauge (ASTM D2922) will be calibrated in accordance with the manufacturer's requirements. Documentation of this calibration will be provided to FDF. Register any nuclear or radiological sources brought on site in accordance with Part 8 of the Contract Documents.
- B. Moisture tests will be performed in accordance with ASTM D3017, ASTM D2216 or ASTM D4643 as applicable.
- C. Moisture-density curves will be determined in accordance with ASTM D698 (Standard Proctor). The test results must be reviewed and approved by FDF prior to use.
- D. If in-place density and/or moisture tests indicate that work does not meet specified requirements, remove work and replace or recompact to specified requirements. If visual inspection indicates that work has not been performed as specified, correct work to comply with the requirements.
- E. Soil classification shall be performed in accordance with ASTM D2487.
- F. Frequency of Tests: Frequency of in-place density and moisture testing shall be whichever of the following requires the greatest number of tests:
  - 1. Once each day of work filling.
  - 2. Once every lift of material.

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3. Once every 500 cubic yards of fill.

Frequency may be lessened only by FDF.

- G. Notify FDF of activities that will require testing/inspection prior to the start of such activities.

END OF SECTION

SECTION 02205  
IMPACTED MATERIAL EXCAVATION AND HANDLING

**PART 1      GENERAL**

**1.1          SECTION INCLUDES**

This section provides requirements for excavation and handling of impacted material encountered during the site preparation phase of the SWUs Project. For excavating and placement of non-impacted material, see Section 02200. Impacted material excavation and handling shall also include all associated geotechnical testing. Classification of excavation material (impacted or non impacted) and subsequent disposition shall be as indicated on the construction drawings. Any deviations from the construction drawings shall be determined and approved by FDF. The work described by this specification shall include, but is not limited to:

- A. The excavation of the top 12-inch layer of material in the retention basin areas as designated on the construction drawings.
- B. Grinding the stumps in place in the borrow-area stockpile area and the retention basin areas.
- C. Presumed Asbestos Containing Material (PACM).
- D. Other impacted material and debris encountered during excavation.

Subcontractor personnel working in the impacted materials area shall comply with the FEMP's Health and Safety requirements, including PPE. Personnel shall also comply with all applicable site training requirements and in accordance with Part 8 of the Contract Documents. All personnel working with impacted material in a Contamination Area shall be FEMP Radiological Worker II trained. A minimum of one subcontractor work crew shall be FEMP Radiological Worker II trained. A minimum of one OSHA

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asbestos competent person (Ohio Department of Health Certified) and two persons with FEMP asbestos O&M training (or equivalent), shall be on site during excavation.

**1.2 RELATED SECTIONS**

- A. Section 01050 - Surveying.
- B. Section 02100 - Site Preparation.
- C. Section 02200 - Non Impacted Material Earthwork.
- D. Section 02270 - Erosion and Sediment Control.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. State of Ohio, Department of Transportation (ODOT): Construction and Material Specifications, January 1, 1997. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM D698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> [600 kN-m/m]).
  - 2. ASTM D2216-92 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
  - 3. ASTM D2487-93 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
  - 4. ASTM D2922-91 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

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5. ASTM D3017-88 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) (R 1993).
6. ASTM D4643-93 Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Method.

## 1.5 SUBMITTALS

Provide the following submittals in accordance with the requirements of Section 01011.

- A. Excavation Work Plan - See requirements in Section 02200
- B. Qualification summary of independent geotechnical laboratory meeting Part 8 of the Contract Documents.
- C. Geotechnical Test Results.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Impacted material consists of all material placed in the area by previous DOE operations and any material above FRL and includes soil, debris, and flyash. Impacted material addressed by this section includes:

- A. Surface soil and other debris not certified being below FRLs by FDF.
- B. Ground stumps and surface soil.
- C. Flyash in the former running track area.
- D. PACM.
- E. Other impacted materials.

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## **2.2 Other Materials**

- A. Geotextile, see Section 02270.**

## **PART 3 EXECUTION**

Perform work in accordance with the requirements in this specification and as further described in the Safe Work Plan.

- A. Subcontractor is to maintain visual observation of excavation and shall notify FDF of any change in material.**
- B. FDF shall furnish all materials, equipment, and personnel for impacted material characterization.**

### **3.1 PREPARATION**

- A. Establish site boundaries and access controls.**
- B. Survey and layout all impacted material work in accordance with Section 01050.**
- C. Clear all trees and brush from the retention basin areas in accordance with Section 02100.**
- D. Notify FDF when conditions differ from those in the contract documents.**
- E. Install appropriate erosion and sediment control measures as shown on the construction drawings.**
- F. Complete non impacted material excavation in the areas proposed for initial installation of geomembrane liner. (Retention basins and ditches).**

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- G. Prior to excavation perform the following process for PACM detection: 1) walk the site, 2) identify PACM, 3) encapsulate (water down), 4) double bag or wrap in two layers of poly material, 5) label, 6) stockpile separately, and 7) banner the PACM stockpile within the impacted material stockpile area.

### 3.2 EXCAVATION

- A. ~~Remove top 12 inches of soil in area of basins not certified by FDF.~~ Grind (with FDF approved stump grinder) all stumps within stockpile and retention basin areas to a minimum depth of 12 inches or to the bottom of the root-mass within 18 inches of the stump in all horizontal directions. Grind to pieces generally smaller than 6 inches in length.

- B. Strip material and ground stump wood chips in the retention basin areas to the following depths:

Retention Basin 1 North Area	18 inches
Retention Basin 1 South Area	12 inches
Retention Basin 2	42 inches
Retention Basin 3	12 inches

Place in the impacted material stockpile on the South Field in the area designated on the construction drawings.

- C. Upon discovery of PACM during excavation follow the requirements of Article 3.1.G of this specification.
- D. Upon discovery of materials requiring contamination posting or other additional control, stop work in that area until FDF establishes proper controls for the area. FDF may require 7 working days to address the problem. During that time, work in another location at no additional cost.
- E. Equipment and material used in the excavation of the impacted material shall remain in the impacted material area until decontaminated, if necessary, and approved

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for release by FDF in accordance with Part 4 of the Contract Documents.

- F. Unexpected discovery of cultural resources: Upon the unexpected discovery of historic, prehistoric, or archeological sites, features, or objects, immediately cease ground disturbing activities at the find and contact FDF.

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**3.3 PLACEMENT OF MATERIAL**

- A. Stockpile impacted material (~~top 12 inches~~) from the retention basin areas in the impacted material stockpile designated on the South Field.
- B. Stockpile the remainder of the excavation from the retention basin areas in the non impacted material stockpile.
- C. FDF will perform monitoring of construction activities for occupational exposure purposes; this monitoring will not relieve the Subcontractor of regulatory responsibilities.

**3.4 COMPACTION**

- A. Impacted material stockpiled on the South Field shall be placed in lifts no more than 12 inches thick and compacted with two passes of a tamping foot or mesh/grid foot roller or equivalent. Maximum height of the stockpile shall be 20 feet with maximum side slopes of 2H:1V.

**3.5 FINISH OPERATIONS**

- A. Grading and Tolerances:  
Plus or minus 0.25 feet of the grades shown on construction drawings, except for the retention basins which shall be 0.1 feet.

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- B. ~~Seeding and Mulching: Seeding and mulching shall be per Section 02900, Soil Preparation and Seeding.~~

Surface controls (crusting agents, e.g., pine sap, emulsion) shall be applied to and maintained on non-impacted stockpiles to minimize erosion.

- C. Seed all distributed areas not associated with the non-impacted stockpiled material in accordance with Section 02900.

END OF SECTION



SECTION 02225  
TRENCHING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Excavation of trenches, compaction of bedding and backfill over storm culverts, drinking water line, transfer line, wheel wash discharge line, discharge line, treatment line, electrical conduits and associated fittings, and appurtenances to elevation.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 01050 - Surveying.
- D. Section 02100 - Site Preparation.
- E. Section 02200 - Non Impacted Material Earthwork.
- F. Section 02205 - Impacted Material Excavation and Handling.
- G. Section 02270 - Erosion and Sediment Control.
- H. Section 02667 - Drinking Water Lines.
- I. Section 02668 - Transfer Line.
- J. Section 02669 - Discharge Line and Treatment Line.
- K. Section 02720 - Site Drainage and Water Management.
- L. Section 02900 - Soil Preparation and Seeding.

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### 1.3 REFERENCE DRAWINGS

- A. See Section 01012 for the Schedule of Drawings.

### 1.4 REFERENCES

- A. State of Ohio, Department of Transportation (ODOT):  
Construction and Material Specifications, January 1,  
1997. Except as supplemented or otherwise modified  
herein and/or shown on the construction drawings, the  
entire work under this section shall be in compliance  
with the provisions of ODOT.
- B. American Society for Testing and Materials (ASTM):
1. ASTM D698-91 Test Method for Laboratory  
Compaction Characteristics of Soil  
Using Standard Effort (12,400 ft-  
lbf/ft<sup>3</sup> [600 kN-m/m]).
  2. ASTM D2216-92 Test Method for Laboratory  
Determination of Water (Moisture)  
Content of Soil and Rock.
  3. ASTM D2487-93 Standard Classification of Soils  
for Engineering Purposes (Unified  
Soil Classification System).
  4. ASTM D2922-91 Standard Test Methods for Density  
of Soil and Soil-Aggregate in Place  
by Nuclear Methods (Shallow Depth).
  5. ASTM D3017-88 Standard Test Method for Water  
Content of Soil and Rock in Place  
by Nuclear Methods (Shallow Depth)  
(R 1993).
  6. ASTM D4643-93 Test Method for Determination of  
Water (Moisture) Content of Soil by  
Microwave Oven Method.

### 1.5 SUBMITTALS

Provide the following submittals as required in Section 01011 and  
Part 6 of the Contract Documents.

- A. Shoring and Sheeting Plan: Provide a shoring and  
sheeting plan as a part of the Safe Work Plan. The  
sheeting and shoring plan shall address removal of

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utilities deeper than 4 feet and all locations where cut slopes shall be steeper than 2H:1V. Describe materials of shoring system to be used. Provide plans, sketches, manufacturer's tabulated data or details, along with calculations by a registered professional engineer. All custom engineered systems shall be approved by an engineer registered in the State of Ohio. Indicate sequence and method of installation and removal.

- B. Geotechnical Test Results: Submit results of all geotechnical tests by the approved geotechnical lab including:
1. Standard Proctor moisture density tests.
  2. Sieve analysis.
  3. Density tests.
  4. Proctor curves for each type material used for approval by FDF prior to use.
- C. As-built Drawings: Provide as-built drawings in accordance with Section 01050.

#### 1.6 QUALITY ASSURANCE PROGRAM

- A. Survey Layout: Assure that all work is laid out and built in accordance with the requirements on the construction drawings and these specifications. Survey work shall be in accordance with Section 01050.
- B. Independent Geotechnical Laboratory: Arrange and pay for the services of a qualified, independent geotechnical testing laboratory. The qualifications of the laboratory, meeting Part 8 of the Contract Documents, must be submitted to FDF and approved in writing prior to initiation of excavation activities. The laboratory must provide documentation of compliance with this specification.

## PART 2 PRODUCTS

### 2.1 MATERIALS

On-site materials shall be used for earthwork activities during excavation, bedding and backfilling for utilities

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unless approved in writing by FDF prior to bringing any material onto the FEMP site.

- A. **Unclassified Material:** ~~Material excavated for utility installation shall be reused for backfill of the trenches.~~ For the purposes of this project, unclassified material is defined as soil removed from a trench prior to the placement of pipe. The removed soil (unclassified material) will be placed back into the trench following the pipe placement. When the pipe is removed from service and physically excavated the soils from the trench will be characterized as impacted or non impacted.
- B. **Coarse Aggregate:** Conforming to ODOT Item 304 - Aggregate Base as modified herein. No slag material will be allowed for use on site. Aggregate shall be crushed carbonate, crushed gravel, or other types of suitable materials ~~meeting the following gradation requirements.~~
- C. **Pipe Bedding:** Sand - natural river or bank sand; free of loam, friable or soluble materials, organic matter; graded in accordance with ASTM D2487; within the following limits:

Sieve Size	Percent Passing
No. 4	70-100
No. 40	20-90
No. 200	0-40

On-site material excavated from the Great Miami Aquifer (from the retention basins) shall be used as pipe bedding provided it meets the above requirements.

### PART 3 EXECUTION

Contact between and/or mixing of impacted material and non-impacted material shall be prevented. Material that contacts impacted material shall be treated as an impacted material in accordance with Section 02205 at no additional cost to FDF. Equipment and materials used in impacted material areas shall be

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kept separate from other equipment and materials until it is properly decontaminated. Impacted material shall be addressed in accordance with Section 2205.

### 3.1 PREPARATION

- A. Verify all backfill/bedding materials to be reused are acceptable. Verify areas to be backfilled are free of debris, snow, ice or water and that surfaces are not frozen.
- B. Survey and layout all work in accordance with Section 01050.
- C. Maintain, identify, and protect existing utilities and features to remain.
- D. Notify FDF when the actual conditions differ in any manner from those specified in the contract documents, or when soft or spongy areas or other unusual soil conditions are encountered.
- E. Install appropriate erosion and sediment control measures in accordance with Section 02270 prior to start of any earthmoving operations.
- F. Immediately stop work and notify FDF if other utility lines not shown on the construction drawings and/or reference drawings are encountered during trenching.

### 3.2 PROTECTION

- A. Grade excavation and trench top perimeter to prevent surface water runoff from entering into excavation or to adjacent properties.
- B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- C. Protect finished work and existing features which will remain.
- D. Protect denuded areas in accordance with Section 02270.

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- E. Protect existing groundwater monitoring wells and extraction wells in the area and in the vicinity of the work area.

### 3.3 EXCAVATION

- A. Trenches and excavations shall be in accordance with OSHA 29 CFR 1926, Subpart P - Excavations.
- B. Excavate trenches to a width necessary for proper installation of pipe to be accommodated as shown on the construction drawings.
- C. Grade bottom of trench to provide uniform bearing and support pipe on properly compacted bedding throughout length of pipe except where necessary to hand excavate for coupling for proper sealing of pipe joints.
- D. Keep trench bottom free of standing water. Provide dewatering pumps as required.
- E. Notify FDF immediately of unexpected subsurface conditions.
- F. Hand excavate for coupling after trench has been fine graded to ensure uniform bearing is provided for pipe.
- G. Remove soft, spongy, or otherwise unstable materials encountered at elevation of pipe which will not provide a firm foundation for the pipe. Extend bedding depth as necessary to reach firm materials.
- H. Backfill unauthorized excavation at Subcontractor's expense with compacted earth as stipulated by FDF.

### 3.4 PIPE BEDDING

- A. Place bedding in level layers not exceeding 6 inches compacted depth to the depths as shown on the drawings.
- B. Compact bedding by five passes of compaction equipment. Each pass shall overlap each preceding pass by at least 2 inches. Compaction equipment shall be vibratory and

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impart at least 2,000 foot-pounds of impact energy with a frequency of 500 bpm, which is similar to a medium size excavator mounted tamping plate/ram.

- C. Employ a placement method that does not disturb or damage pipe or trench.
- D. Support pipe during placement and compaction of bedding fill.
- E. When proposed utilities cross the existing 6-inch gas line, the existing 6-inch drinking water line, and/or the existing 20-inch groundwater line, place compacted bedding material to an elevation one foot above the highest utility. Backfill from this point to the original ground elevation with coarse aggregate as specified herein for vehicle crossing locations.

### 3.5 BACKFILLING

- A. Prepare subgrade as follows:
  - 1. Compact exposed subgrade to density requirements for subsequent backfill materials. When existing ground surface has a density of less than the density specified, break up the ground surface, pulverize, adjust moisture content to specified limits, and compact to specified density.
  - 2. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with material and compact to density equal to or greater than requirements for subsequent fill material.
- B. Do not backfill over porous, wet, frozen, spongy, or other unsatisfactory subgrade surfaces. Where unsatisfactory subsurface conditions in an area of backfill are observed, excavate unsatisfactory material to satisfactory subgrade as approved by FDF.
- C. Backfill trenches in non-traffic areas with unclassified material to contours and elevations shown. Place and compact fill materials in level layers not exceeding 12 inches loose depth. Do not use frozen or saturated

materials. Compact backfill to 90 percent Standard Proctor as determined by ASTM D2922.

- D. Backfill trenches in traffic areas with ~~coarse~~ aggregate. Place and compact in 6-inch lifts and compact to 95 percent Standard Proctor as determined by ASTM D2922.
- E. Maintain optimum moisture content as determined by ASTM D3017, ASTM D2216 or ASTM D4643, as applicable, (within  $\pm 4$  percent) of backfill materials to attain required compaction density.
- F. Seed all disturbed areas in accordance with Section 02900.
- G. Dust Suppression: See Section 02100 and Part 6 of the Contract Documents.
- H. Install underground warning tape.

### 3.7 FIELD QUALITY CONTROL

- A. Moisture-density curves will be determined in accordance with ASTM D698 (Standard Proctor).
- B. If in-place density and/or moisture tests indicate that work does not meet specified requirements, remove work and replace or recompact to specified requirements. If visual inspection indicates that work has not been performed as specified, correct work to comply with the requirements.
- C. Frequency of Tests (Backfill only): Frequency of in-place density and moisture testing shall be whichever of the following requires the greatest number of tests:
  - 1. Once each day of work filling.
  - 2. Once every layer of fill.
  - 3. Once every 500 cubic yards of fill.
  - 4. Once every 200 feet of trench.
- D. Notify FDF Manager of activities that will require testing/inspection prior to the start of such activities.

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- E. Register any nuclear or radiological sources brought on site in accordance with Part 8 of the Contract Documents.

END OF SECTION

SECTION 02270  
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Soil erosion and sedimentation control for areas of the Subcontractor's work area which are graded or disturbed as a part of the contract work.
- B. Installation and maintenance of all temporary erosion and sediment control facilities and measures.
- C. Installation of erosion control blankets.
- D. Dumped rock fill for ditches, erosion control areas, SWRB overflow, and swale repair as indicated on the construction drawings.
- E. Geotextile fabric underneath ~~geomembrane liner~~ impacted material stockpile.
- F. Geotextile (geosynthetic fabric) for Silt Berm and Sediment Barrier installation.

1.2 RELATED SECTIONS

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02100 - Site Preparation.
- D. Section 02200 - Non Impacted Material Earthwork.
- E. Section 02205 - Impacted Material Excavation and Handling.
- F. Section 02720 - Site Drainage and Water Management.

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G. Section 02900 - Soil Preparation and Seeding.

### 1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

### 1.4 REFERENCES

- A. State of Ohio, Department of Transportation (ODOT):  
Construction and Material Specifications, January 1, 1997.
- B. State of Ohio, Department of Natural Resources (ODNR):  
Rainwater and Land Development, Ohio's Standard for  
Stormwater Management, Land Development, and Urban Stream  
Protection - 1996.
- C. American Society for Testing and Materials (ASTM):
1. ASTM D1777-96 Standard Test Method for  
Measuring Thickness of Textile  
Materials (R 1975).
  2. ASTM D3776-96 Standard Test Method for Mass  
Per Unit Area (Weight) of  
Woven Fabric (R 1990).
  3. ASTM D3786-87 Standard Test Method for  
Hydraulic Bursting Strength of  
Knitted Goods and Nonwoven  
Fabrics - Diaphragm Bursting
  4. ASTM D4491-95 Standard Test Method for Water  
Permeability of Geotextiles by  
Permissivity.
  5. ASTM D4533-91 Standard Test Method for  
Trapezoid Tearing Strength of  
Geotextiles.
  6. ASTM D4632-91 Standard Test Method for Grab  
Breaking Load and Elongation  
of Textiles.
  7. ASTM D4751-95 Standard Test Method for  
Determining Apparent Opening  
Size of a Geotextile.
  8. ASTM D4833-88 Standard Test Method for Index  
Puncture Resistance of

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Geotextiles, Geomembranes, and  
Related Products.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.
- B. Provide as a part of the Excavation Work Plan the types of materials, equipment and installation procedures to be used for the construction and installation of the Silt Berm and Sediment Barrier. Include the types and frequency of fasteners to be used and a procedure to prevent damage to the geomembrane liner during installation. Submit for approval by FDF.

**1.6 QUALITY ASSURANCE PROGRAM**

- A. Inspect sediment control measures weekly and after each rain exceeding 0.5 inches to evaluate the effectiveness of the control measures and for maintenance of the control measures. Records of inspections shall be kept on file at Subcontractor's site office and shall be submitted monthly to FDF.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Stakes: Stakes shall be hardwood with a minimum length of 2 feet, 8 inches in height and 2 inches by 2 inches in width.
- B. Silt Fence: Materials shall conform to ODOT Item 712.09, Type C for material as described in ODOT Section 207.02 and as specified in the construction drawings.
- C. Dumped Rock Fill: Dumped rock fill shall meet the requirements of ODOT Item 601.07 for the type specified on the construction drawings.

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- D. Non-woven geotextile fabric for dumped rock fill and ~~geomembrane liner bedding~~ impacted material stockpile bedding similar to Trevira No. 1125™ or approved equivalent.
- E. Non-woven geotextile fabric for Silt Berm and Sediment Barrier similar to Trevira No. 1125™ or approved equivalent.
- 
- F. Silt Berm / Sediment Barrier shall be constructed using equipment manufactured by MBW Inc. or approved substitute.
- G. Fill material for the Silt Berm/Sediment Barrier shall be ODOT Item 703.01, #57 stone.
- H. Fasteners for Silt Berm/Sediment Barrier.
- I. Erosion Control Blankets: Similar to North American Green Type C125 or approved equal. The erosion control blanket shall be constructed of 100 percent coconut fiber stitch bonded between a heavy duty UV stabilized bottom net and a heavy duty UV stabilized top net. The cusped (crimped) netting shall form prominently closely spaced ridges across the entire width of the mat. The nettings shall be stitched together on 1.5 inch centers with UV stabilized polyester thread to form a permanent three dimensional structure. The mat shall have the following physical properties and rated for two years service life for use on slopes of 1:1.
1. Material Content
    - a. Coconut fiber: 100 percent; 0.5 lb/yd<sup>2</sup>
    - b. Nettings: Top - Heavy UV stabilized; polypropylene; 3 lbs per 1,000 ft<sup>2</sup>. Bottom - Heavy UV stabilized; polypropylene; 3 lbs per 1,000 ft<sup>2</sup>.
    - c. Thread: UV stabilized polyester.
  2. Physical Specifications (Roll)
    - a. Width: 6.5 feet
    - b. Length: 83.5 feet
    - c. Weight: 30 lbs ±10 percent
    - d. Area: 60 yd<sup>2</sup>

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**PART 3 EXECUTION**

Construct protective devices as specified herein, and as required on the construction drawings.

**3.1 SILT FENCES**

- A. Install in accordance with ODNR and manufacturer's recommendations. Place at locations shown on construction drawings prior to start of earthwork. Remove accumulated silts when deposition reaches one-half the height of the silt fence or sooner if accumulated sediment prevents proper performance of silt fence.

**3.2 EROSION CONTROL BLANKETS**

- A. Install in accordance with manufacturer's recommendations in the ditches shown on the construction drawings. All blankets shall be properly anchored with wire staples in patterns and sizes recommended by manufacturer.

**3.3 GEOTEXTILE**

- A. Install geotextile ~~on prepared subgrade~~ underneath the ~~geomembrane liner~~ impacted material stockpile in accordance with the manufacturer's recommendations.

**3.4 INACTIVE EXPOSED EXCAVATION & CONSTRUCTION AREAS**

- A. All exposed denuded (i.e., no vegetation) construction and impacted material excavation/~~stockpile~~ areas that are inactive shall be stabilized by means of temporary seeding in accordance with Section 02900. Forty-five days is the maximum time that an area can be left in a exposed denuded state. If the exposed area will not be worked for a period of 45 days, the soils must be stabilized within 7 days.

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- B. All stockpiles that are inactive shall be stabilized by means of crusting agents (e.g., pine sap emulsion). Forty-five days is the maximum time that an area can be left in a exposed denuded state. If the exposed area will not be worked for a period of 45 days, the soils must be stabilized within 7 days.

### 3.5 RETENTION BASINS

- A. Vegetation/grass is to be established on slopes of all retention basins from the sediment clean out elevation to the top of slope.
- B. Slopes and bottom of retention basin are to be maintained. The area is to be kept free of any erosion rills and gullies.
- C. See Section 02900 for seeding.
- D. Remove accumulated sediments, debris, and obstructions. In no case shall sediment build up to a depth greater than levels indicated on the drawings.
- E. All sediments removed shall be transported to the impacted material stockpile located within South Field as indicated on the construction drawings.
- F. Inspect and maintain infiltration barrier as required to maintain the one-foot of barrier material over the GMA. After placement of the infiltration barrier but prior to placement of the HDPE liner, proofroll and recompact the infiltration barrier as necessary to re-establish the original thickness and compaction. Proofrolling of the ditches and retention basin side slopes is not required.

### 3.6 DUMPED ROCK FILL

- A. Install in accordance with ODOT Item 601.07 in ditches where indicated on the construction drawings.

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- B. Install geotextile with dumped rock fill in accordance with ODOT Item 601.08 in ditches where indicated on the construction drawings.

### 3.7 INSTALLATION OF SILT BERM/SEDIMENT BARRIER

- A. Install Silt Berm/Sediment Barrier in locations as indicated on the construction drawings.
- B. Use caution during installation to prevent damage to exposed geomembrane liner.
- C. Fasteners used for closing openings of Silt Berm/Sediment Barrier shall be spaced to prevent spillage of fill materials in accordance with manufacturer's recommendations.
- D. If visual inspection indicates that work has not been performed as specified, correct work to comply with the requirements.

### 3.8 REMOVAL OF TEMPORARY EROSION CONTROL FACILITIES

- A. Proposed sediment control facilities on the construction drawings are placed as a minimum. Install additional temporary facilities as required to maintain control of erosion and sedimentation.
- B. Temporary erosion control facilities installed shall be removed at the direction of FDF after the disturbed areas are stabilized with grass or other measures approved by FDF.

END OF SECTION



SECTION 02506  
AGGREGATE SURFACE

**PART 1 GENERAL**

**1.1 SCOPE**

- A. Installation and compaction requirements for aggregate surfaces for roads and the support area. Section also addresses geotextile fabric.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Non-impacted Material Earthwork.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society for Testing And Materials (ASTM):
  - 1. ASTM D698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>).
  - 2. ASTM D2216 -92 Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
  - 3. ASTM 2922-91 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
  - 4. ASTM D3017-88 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

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- B. State of Ohio, Department of Transportation (ODOT), Construction and Material Specifications, January 1, 1997: Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

## **1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.
- B. Materials Source: Submit names of imported materials suppliers. Change of source requires FDF's approval.
- C. Material suppliers shall be required to certify that supplied materials meet specifications prior to use.
- D. Submit name and address of testing laboratory for approval. Provide FDF with copies of all lab/field test results.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Aggregate materials shall meet the requirements of ODOT Item 304. Aggregate: The aggregate shall be crushed carbonate stone, crushed gravel, or other types of suitable materials meeting the requirements of this item. No slag materials will be allowed for use on site.
- B. Geotextile fabrics shall conform to ODOT Item 712.09, Type D.
1. The fabric shall consist of a woven polyester or polypropylene fibers formed into a woven fabric.
  2. Product and manufacturers.
    - a. 500X by Nicolon/Mirifi Group.
    - b. 2002 by Amoco Fabrics and Fibers Co.
    - c. Or approved equal.

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**PART 3 EXECUTION****3.1 SURVEY AND CONSTRUCTION STAKEOUT**

- A. Verify grades and elevations of subgrade are correct.

**3.2 SUBGRADE PREPARATION**

- A. Verify that compacted subgrade is dry and not frozen, soft, or spongy.

**3.3 GEOTEXTILE INSTALLATION**

Place geotextile on subgrade in accordance with manufacturer's installation instructions and as follows:

- A. Geotextile fabric shall be placed directly over the subgrade. The geotextile fabric shall be placed and temporarily anchored in such a manner that placement of overlying materials will not excessively stretch or tear the fabric.
- B. Geotextile fabric shall be installed to limits and grades indicated on plans for all new work. The geotextile shall not be dragged across the subgrade. The geotextile fabric shall be unrolled as smooth as possible on the prepared subgrade. Wrinkles and folds in the geotextile shall be removed by stretching and placing of sod staples or small aggregate piles as required. The fabric shall be installed according to the manufacturer's suggestion at curve locations.
- C. The geotextile shall be field joined, factory seamed, or manufactured in seamless width. Methods of field joining shall include overlapping of adjacent edges and ends of geotextile or sewing of adjacent edges and ends of geotextile. Sand bags or other weights may be used for temporary anchoring. Overlap at edges and ends of geotextile shall be per Manufacturer's Installation Instructions.

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- D. The geotextile fabric shall extend to the edges of the road aggregate surface.
- E. Exposure of geotextiles to elements between lay down and cover shall be a maximum of 7 days to minimize damage ~~potential~~ by ultraviolet light.
- F. Construction traffic shall not be permitted directly on the geotextile fabric.

### 3.4 AGGREGATE INSTALLATION

- A. End dumping or tailgate dumping shall not be permitted directly onto the geotextile fabric. The aggregate shall be dumped adjacent to the fabric or on previously placed stone. The aggregate shall be spread from the backdumped pile using a bulldozer, loader, track hoe, or grader, with care being taken to avoid damage to the fabric by blades, tracks, tires, or buckets. The initial lift of aggregate on the geotextile fabric shall be a minimum thickness of 6 inches after compaction and shall be compacted with a smooth drum roller to the required density.

### 3.5 COMPACTING AGGREGATE

- A. Compact aggregate surface to 95 percent of optimum density in accordance with ASTM D698. Maintain within  $\pm 4$  percent of optimum moisture content of fill materials to attain required compaction density.
- B. If in-place density and/or moisture tests indicate that work does not meet specified requirements, remove work and replace or recompact to specified requirements. If visual inspection indicates that work has not been performed as specified, correct work to comply with requirements.

### 3.6 FIELD QUALITY CONTROL

- A. Work shall be performed in accordance with ODOT Item 304 requirements.

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**B. Tolerances**

1. The top of the aggregate surface shall be a uniformly smooth grade surface without high or low points and shall not be more than 0.25 feet above or below specified grades.
2. The thickness of the finished aggregate course shall be no less, at any point, than the thickness indicated on the construction drawings.

**C. Frequency of Tests: Frequency of in-place density and moisture testing shall be whichever of the following requires the greatest number of tests:**

1. Once each day of work filling.
2. Once every lift of material.
3. Once every 500 cubic yards of fill.

**D. Maintain all aggregate surfaces to the minimum requirements of this specification and the construction drawings.**

**END OF SECTION**

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SECTION 02510  
ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.1 SCOPE

- A. This section describes the asphaltic concrete paving and aggregate base that will be used to pave the access roads to and from the wheel wash pad.

1.2 RELATED SECTIONS

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Non-impacted Material Earthwork.

1.3 REFERENCE DRAWINGS

- A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

- A. American Society for Testing And Materials (ASTM):
  - 1. ASTM D698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>).
- B. State of Ohio, Department of Transportation Construction and Material Specifications, January 1, 1997 (ODOT). Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

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**1.5 ENVIRONMENTAL REQUIREMENTS**

- A. Weather Limitations: Shall be in accordance with ODOT Item 401.05.

**1.6 QUALITY ASSURANCE**

- A. Materials and workmanship specified herein with the referenced State Standard specifications shall be in accordance with the referenced articles, sections, and paragraphs of the standard except that contractual and payment provisions do not apply. Where the term "Engineer" is used, it shall mean FDF. Where the term "State" is used, it shall mean DOE.

**1.7 SUBMITTALS**

- A. Submit the following in accordance with Section 01011 and Part 6 of the Contract Documents.
1. Mix Design: Develop mix design and submit results of laboratory tests performed on each mix design in accordance with ODOT Item 441.
  2. Certificates: Submit certificates, signed by the producer, that paving materials conform to mix design and specification requirements.

**PART 2 PRODUCTS**

**2.1 EQUIPMENT**

- A. Equipment used in paving operations shall be in accordance with ODOT Item 401.

**2.2 MATERIALS**

- A. Bituminous aggregate base shall meet the requirements of ODOT Item 301.
- B. Aggregate base shall meet the requirements of ODOT Item 304.

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1. Aggregate: The aggregate shall be crushed carbonate stone, crushed gravel, or other types of suitable materials meeting the requirements of this item. No slag materials will be allowed for use on site.

C. Asphalt concrete shall meet the requirements of ODOT Item 403.

1. Composition: Coarse aggregate (No. 8) and fine aggregate shall be combined in such proportions that the resulting blend shall be as directed by the approved design mix.

D. Tack coat shall meet the requirements of ODOT Item 407.

1. Material: The bituminous material shall meet the applicable requirements of 702 and shall be one of the following: 702.02 RC-70, RC-250, or 702.04 RS-1, SS-1, SS-1h, CRS-1, CSS-1, or CSS-1h. Cut-back asphalt 702.02 may be used only after September 15 and before May 15.

E. Prime coat shall meet the requirements of ODOT Item 408.

1. Material: The bituminous material shall meet the applicable requirements of 702 and shall be one of the following: 702.02 RC-70, RC-250, MC-30, MC-70, MC-250, or 702.03 Primer 20.

F. Joint sealant shall meet the requirements of ODOT Item 407.

1. Material: The bituminous material shall be one of the following:
  - a. SS-1.
  - b. CSS-1.

### PART 3 EXECUTION

#### 3.1 EXAMINATION AND PREPARATION

- A. Verify gradients and elevations of base.
- B. Verify that compacted subgrade is dry.

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### 3.2 AGGREGATE BASE CONSTRUCTION

- A. Fill areas to contours and elevations using unfrozen materials.
- B. Place base materials in continuous layers not exceeding 6 inches compacted depth.
- C. ~~Compact to 95 percent of optimum density in accordance with ASTM D698.~~
- D. Maintain within  $\pm 4$  percent of optimum moisture content of fill materials to attain required compaction density.

### 3.3 PLACING ASPHALT PAVEMENT

- A. Apply prime coat to finished base surface in accordance with manufacturer's instructions.
- B. Place bituminous asphalt base course within 8 hours of priming aggregate base surface.
- C. Clean bituminous surface and apply tack coat as required prior to placing succeeding courses of asphalt.
- D. Spread, compact, and finish each course of asphalt pavement by rolling to achieve even and smooth finish, without roller marks in accordance with ODOT Item 401. Hand-compact in areas inaccessible to rolling equipment.

### 3.4 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
- B. Compacted Scheduled Thickness: Within 1/4 inch of design thickness.
- C. Variation from True Elevation: Within 1/2 inch.

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### 3.5 FIELD QUALITY CONTROL

- A. Perform work in accordance with ODOT requirements.
- B. Coordinate and pay for all testing which shall be performed by an independent testing laboratory.
- C. All inspections and test results shall be provided to FDF within 24-hours of completion.
- D. Notify FDF of testing/inspection activities at least 24-hours prior to the start of all tests or inspections.
- E. If in-place density and/or moisture tests indicate that work does not meet specified requirements, remove work and replace or recompact to specified requirements. If visual inspection indicates that work has not been performed as specified, correct work to comply with requirements.

END OF SECTION

SECTION 02667  
DRINKING WATER LINES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Pipe and fittings for drinking water lines (DW).
- B. Disinfection of drinking water lines and subsequent testing and reporting of those lines.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Non-impacted Material Earthwork.
- D. Section 02225 - Trenching.
- E. Section 03001 - Concrete.
- F. Section 15060 - Pipe Fittings, Valves, and Accessories.
- G. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36/A36M-96 Carbon Structural Steel.
  - 2. ASTM A53-96 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

- |    |               |   |
|----|---------------|---|
| 3. | ASTM A325-96  | Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength.  |
| 4. | ASTM D3035-95 | Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.                       |
| 5. | ASTM D3261-95 | Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing. |
| 6. | ASTM D3350-96 | Standard Specification for Polyethylene Plastic Pipe and Fittings Material.   |

B. American Water Works Association (AWWA):

- |     |                         |   |
|-----|-------------------------|---|
| 1.  | AWWA B300-92            | Standard for Hypochlorites.   |
| 2.  | AWWA B301-92            | Standard for Liquid Chlorine.   |
| 3.  | AWWA B302-95            | Standard for Ammonium Sulfate.  |
| 4.  | AWWA B303-95            | Standard for Sodium Chlorite.   |
| 5.  | AWWA C104/<br>A21.4-95  | Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.                        |
| 6.  | AWWA C105/<br>A21.5-93  | Polyethylene Encasement for Ductile-Iron Pipe Systems.                                    |
| 7.  | AWWA C110/<br>A21.10-93 | Ductile-Iron and Gray-Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids. |
| 8.  | AWWA C111/<br>A21.11-95 | Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.                         |
| 9.  | AWWA C115/<br>A21.15-94 | Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Fittings.               |
| 10. | AWWA C150/<br>A21.50-91 | Thickness Design of Ductile-Iron Pipe.  |
| 11. | AWWA C151/<br>A21.51-91 | Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.                        |

- 12. AWWA C500-93 Metal-Seated Gate Valves for Water Supply Service.
  - 13. AWWA C550-90 Protective Epoxy Interior Coatings for Valves and Hydrants.
  - 14. AWWA C600-93 Installation of Ductile-Iron Water Mains and Their Appurtenances.
  - 15. AWWA C651-92 Standards for Disinfecting Water Mains.
  - 16. AWWA C906-90 Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution.
  - 17. AWWA M12-75 Simplified Procedure for Water Examination.
- C. Ohio Revised Code (ORC):
- 1. ORC 3745-83 Operational Requirements.
- D. American Welding Society, Inc. (AWS):
- 1. AWS D1.1-96 Structural Welding Code - Steel.
- E. State of Ohio, Department of Transportation (ODOT), Construction and Materials Specifications, January 1, 1997.
- F. Steel Structures Painting Council (SSPC):
- 1. SSPC SP 6-94 Surface Preparation Specification No. 6 - Commercial Blast Cleaning.

## 1.5 SUBMITTALS

- A. Product Data: Provide data on all pipe materials, pipe fittings, valves, accessories, and the methods and equipment for HDPE fusion welding.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- C. Provide As-Built information in accordance with Section 01050 - Surveying.
- D. Certificate: Certify that cleanliness of water lines meets or exceeds specified requirements.
- E. Verification of a minimum of five years experience in HDPE pipe installation and fusion/extrusion welding.
- F. Project Record Documents: Provide data below.
  - 1. Disinfection report; record:
    - a. Type and form of disinfectant used.
    - b. Date and time of disinfectant injection start and time of completion.
    - c. Test locations.
    - d. Initial and 24-hour disinfectant residuals (quantity in treated water), in ppm, for each outlet sampled.
    - e. Date and time of flushing start and completion.
    - f. Disinfectant residual after flushing, in ppm, for each outlet sampled.
  - 2. Bacteriological report: Submit to FDF.

## **1.6 QUALITY ASSURANCE**

- A. Piping and Valves: Manufacturer's name and pressure rating marked on valve body and side of pipe.
- B. Perform work in accordance with AWWA C651.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Pipe
  - 1. High-Density PE Pipe: AWWA C906 (PE 3408), ASTM D3035, ASTM D3350, SDR and pressure rating as indicated on drawings.
    - a. Fitting: AWWA C906, molded, butt fusion weld to pipe.

- b. Joints: Butt fusion, flanged gasket joints, and molded adapter pipe at interface connections with ductile iron or carbon steel pipe and valves, bolts per ASTM A325.
    - c. Trace Wire: Magnetic detectable conductor, blue colored plastic covering.
  - 2. Ductile Iron Pipe: AWWA C151, Class 55:
    - a. Fittings: AWWA C110, Ductile iron cement lined, standard thickness per AWWA C150. All fittings and pipe at valves shall be flanged per AWWA C115, bolts per ASTM A325.
    - b. Jackets: AWWA C105, PE encasement.
    - c. Cement Lined: AWWA C104, cement mortar lined.
    - d. Joints: AWWA C111, push-on, rubber gasket.
    - e. Welding: Shop welding - AWS D1.1.
  - 3. Carbon Steel: See Section 15060 for materials and installation.
- B. Gate Valves (Underground)
  - 1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, Class 125 flanged ends, control rod, extension box, and valve key.
- C. Bedding Materials
  - 1. Bedding: As specified in Section 02225 of this specification package.
- D. Backfill Materials
  - 1. Backfill: As specified in Section 02225 of this specification package.
- E. Backflow Preventer: As specified on the construction drawings.
- F. Post Hydrant: See Section 15060 for materials and installation.
- G. Backflow Preventer Assembly: AWWA approved reduced pressure principle backflow preventer similar to Conbraco Industries, Inc., Model 40-208-02 with ball valves, flanged ends and 1/4-inch test cocks.

H. Guard Posts: Steel pipe, ASTM A53, Schedule 40.

I. Protective Coatings for Valves:

1. Interior - Factory applied heat-cured epoxy coating conforming to AWWA C550.
2. Exterior - Two coats of factory applied zinc chromate primer and two coats finish coating in accordance with metal painting specifications in Part 3.3.E.

J. Tapping Sleeves: JCM 412 Flanged Outlet Tapping Sleeve by JCM Co. or approved equivalent.

K. Disinfection Chemicals:

1. Chemicals: AWWA B300, Hypochlorite; AWWA B301, Liquid Chlorine; AWWA B302, Ammonium Sulfate; and AWWA B303, Sodium Chlorite.
2. The above listed chemicals will be considered hazardous by FEMP standards if they become waste or if allowed to spill.

## **2.2 ACCESSORIES**

A. Concrete: See Section 03001.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions. Any discrepancies should be brought to FDF's attention in a written statement immediately upon discovery.
- B. Verify that service connection and site utility water main size, location, and invert are as indicated.
- C. Regulatory Requirements for Disinfection:
  1. Conform to applicable code or regulation for performing the work of this section, to include US Public Health Service Drinking Water Standards identified in AWWA M12 as well as ORC 3745-83.

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### 3.2 PREPARATION

- A. Ream pipe and tube ends and remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Excavate pipe trench in accordance with Section 02225 of this specification package for work of this section. Locate all existing utilities in the area and determine if they will interfere with the proposed utility.

### 3.3 ERECTION/INSTALLATION/APPLICATION

- A. Installation - Pipe: HDPE
  - 1. Install pipe to indicated elevation to within tolerance of 5/8-inches at structures.
  - 2. Install HDPE piping and fittings to AWWA C906 (by butt weld fusion method, in accordance with ASTM D3261).
  - 3. Route pipe in line as shown on drawing. The minimum bending radius shall be as specified by the pipe manufacturer. Pipe shall be in a straight route at connections.
  - 4. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendation.
  - 5. Establish elevations of buried piping to ensure not less than 3.5 feet of cover.
  - 6. Install trace wire continuous over top of pipe, 6 inches above pipe line; coordinate with Section 02225 of this specification package.
  - 7. Backfill trench in accordance with Section 02225 of this specification package.
- B. Installation of Pipe and Valves: Carbon Steel, Fittings and Post Hydrants
  - 1. See Section 15060 for materials and installation.
- C. Installation - Guard Post
  - 1. Excavate for post and concrete in accordance with Section 02200.
  - 2. Hand trim and remove loose material in excavation.

3. Position pipe in hole, maintaining clearances as specified on drawings.
4. Place concrete around and in pipe in accordance with Section 03001.
5. Paint post after concrete cures in accordance with ODOT Item 514.

D. Installation - Tapping Sleeves.

1. Make a wet tap into existing water line using tapping sleeve and tapping valve. After completing wet tap, install balance of fittings and pipeline to complete the work.

E. Shop and Field Painting Specification:

For Steel Plate and Shapes, Pipe and Fittings

1. Prepare surfaces in accordance with Steel Structures Painting Council (SSPC) SP-6.
2. Prime all bare metal not in contact with concrete/grout with one coat Tnemec Series 6 Epoxo Line Primer. Apply two-coats of Tnemec Series 66 Hi-Build Epoxoline for the finish coat. Follow SSPC Paint 13 and Paint 20.

F. Excess Debris and Waste: Shall be stockpiled in either the impacted material stockpile or the non impacted material stockpile.

G. For concrete installation see Section 03001.

3.4 DISINFECTION

- A. Introduce treatment into piping system.
- B. Maintain disinfectant in system for 24 hours.
- C. Flush, circulate, and clean until required cleanliness is achieved; use potable water.
- D. Replace permanent system devices removed for disinfection.
- E. Seal the piping system immediately after disinfection to ensure that contaminants do not enter the system.

- F. Containerize all flush water. Water shall be dechlorinated or otherwise treated and disposed of per FDF.

**3.5 FIELD QUALITY CONTROL**

- A. Perform hydrostatic tests on all lines in accordance with AWWA C600. Notify FDF at least 24 hours in advance of planned testing.
- B. Provide analysis and testing of treated water in accordance with AWWA C651. Submit report to FDF within one week after completion of test.
- C. All testing and disinfection shall be complete and accepted by FDF prior to connecting existing water supply line.

**END OF SECTION**

SECTION 02668  
TRANSFER LINE

**PART 1      GENERAL**

**1.1          SECTION INCLUDES**

- A.      Pipe and fittings for stormwater transfer force main.
- B.      HDPE Manholes, frames, and lid.
- C.      Clean-outs.
- D.      Air Release Valves.
- E.      Guard posts.

**1.2          RELATED SECTIONS**

- A.      Section 01000 - General Requirements.
- B.      Section 01011 - Submittals.
- C.      Section 02200 - Non-impacted Material Earthwork.
- D.      Section 02225 - Trenching
- E.      Section 02720 - Site Drainage and Water Management.
- F.      Section 03001 - Concrete.
- G.      Section 15060 - Pipe Fittings, Valves, and Accessories.
- H.      Section 15160 - Lift Station Pumps.
- I.      Section 16050 - Basic Electrical Materials and Methods.

**1.3          REFERENCE DRAWINGS**

- A.      See Section 01012 for the Schedule of Drawings.

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#### 1.4

#### REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. ASTM A36/  
A36M-96 Standard Specification for Carbon Structural Steel.
  2. ASTM A53-96 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  3. ASTM A325-96 Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength.
  4. ASTM D3035-95 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
  5. ASTM D3261-95 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
  6. ASTM D3350-96 Standard Specification for Polyethylene Plastic Pipe and Fittings Material.
- B. American Water Works Association (AWWA):
1. AWWA C500-93 Metal-Seated Gate Valves for Water Supply Service.
  2. AWWA C550-90 Protective Epoxy Interior Coatings for Valves and Hydrants.
  3. AWWA C906-90 Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution.
  4. AWWA C600-93 Installation of Ductile-Iron Water Mains and Their Appurtenances.
- C. American Welding Society, Inc. (AWS):
1. AWS D1.1-96 Structural Welding Code - Steel.

- D. State of Ohio, Department of Transportation (ODOT), Construction and Materials Specifications, January 1, 1997.
- E. Steel Structures Painting Council (SSPC):
  - 1. SSPC SP 6-94 Surface Preparation Specification No. 6 - Commercial Blast Cleaning.
  - 2. SSPC Paint 13-91 Red or Brown One-Coat Shop Paint.
  - 3. SSPC Paint 20-91 Zinc Rich Primers (Type I, Inorganic and Type II, Organic).

#### 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.
- B. Product Data: Provide data on all pipe materials, pipe fittings, valves, accessories, the methods and equipment for HDPE fusion welding, HDPE manholes, and manhole frame and cover.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Verification of a minimum of five years experience in HDPE manhole installation and HDPE single and double contained pipe installation and fusion/extrusion welding.
- E. Provide as-built information in accordance with Section 01050.
- F. Provide detailed shop drawings for approval of all HDPE manholes. Drawings shall show plan and section view of manhole, invert of pipes, pipe sizes, pipe orientation, and weld types/details.

**1.6 QUALITY ASSURANCE**

- A. Piping and Valves: Manufacturer's name and pressure rating marked on valve body and side of pipe.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

**A. Pipe**

1. High-Density PE Pipe: AWWA C906 (PE 3408), ASTM D3035, SDR and pressure rating as indicated on drawings.
  - a. Fitting: AWWA C906, molded, butt fusion weld to pipe.
  - b. Joints: Butt fusion for HDPE joints, flanged gasket joints, and molded adapter pipe at interface connections with ductile iron or carbon steel pipe and valves.
  - c. Trace Wire: Magnetic detectable conductor, green colored plastic covering.
  - d. Dual Containment Pipe: All dual containment pipe and fittings shall be prefabricated using carrier and containment sizes, and SDR ratings as indicated on drawings. Support spacers shall be used in the annular space between the pipes to ensure a continuous space between to accommodate possible leakage from the carrier pipe. The carrier pipe shall extend 6 inches beyond containment pipe on all prefabricated pipe sections and fittings. All joints shall be per the manufacturer's recommendation.
2. Carbon Steel: See Section 15060 for materials and installation.

**B. Bedding Materials**

1. Bedding: Fill as specified in Section 02225 of this specification package.

**C. Backfill Materials**

1. Backfill: Fill as specified in Section 02225 of this specification package.

- D. Manhole: HDPE, ASTM D3350. Pipe resin is cell classification 3454-34C and a plastic pipe Institute Rating of PE 3408. The manhole shall have lifting lugs capable of supporting manhole during placement and shipping. The cylinder and outlet shall be fabricated from HDPE pipe with SDR, same as pipe, as indicated on drawings. All components shall be joined by butt fusion, saddle fusion, socket fusion, or extrusion welding. Hot air welding is not acceptable. Each manhole shall be identified by appropriate manhole number visibly marked on interior and exterior. HDPE molded pipe stubs and ductile iron flanged backup rings in manholes shall be installed in manhole by shop fabrication.
- E. Manhole frame and lid shall be as noted on the construction drawings.
- F. For lift station pumps and guide rail see Section 15160. For lift station controls and electrical, see Section 16050.
- G. Guard Posts: Steel pipe, ASTM A53, Schedule 40.
- H. Protective Coatings for Valves:
1. Interior - Factory applied heat-cured epoxy coating conforming to AWWA C550.
  2. Exterior - Two coats of factory applied zinc chromate primer and two coats finish coating in accordance with metal painting specifications in Part 3.3.D.
- I. Manhole Pipe Supports:
- Material used shall meet the following specifications:
1. Structural Steel - ASTM A36.
  2. Bolts, Nuts, and Washers - ASTM A325.
  3. Welding - AWS D1.1 Class E70XX electrodes.
  4. Expansion Anchors: Drilled expansion bolts for securing steel to concrete.
    - a. Kwik Bolt, by Hilti, Inc.
    - b. Parabolt, by Molly Fastener Group.
    - c. Wedge Anchors, by ITW Ramset/Red Head.



J. Clean outs shall be as specified on the construction drawings.

K. Air Release Valves shall be as specified on the construction drawings.

## **2.2 ACCESSORIES**

A. ~~Concrete: See Section 03001.~~

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

A. Verify existing conditions. Any discrepancies should be brought to FDF's attention in a written statement immediately upon discovery.

### **3.2 PREPARATION**

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Excavate pipe trench in accordance with Section 02225 of this specification package for work of this section. Locate all existing utilities in the area and determine if they will interfere with the proposed utilities.

### **3.3 ERECTION/INSTALLATION/APPLICATION**

A. Installation - Manhole and Pipe: HDPE

1. Maintain separation of transfer line from potable water piping (18-inch vertical minimum).
2. Install pipe to indicated elevation to within tolerance of 5/8 inches at structures.
3. Install HDPE piping, manholes, and fittings to AWWA C906 (by butt weld fusion method, in accordance with ASTM D3261).

4. Route pipe in line as shown on construction drawing. The minimum bending radius shall be as specified by the pipe manufacturer. Pipe shall be in a straight route at manhole connections.
5. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendation.
6. Form and place concrete for thrust blocks at each "Tee" of pipe main.
7. Establish elevations of buried piping to ensure not less than 3.5 feet of cover.
8. Install trace wire continuous over top of pipe, 6 inches above pipe line.
9. Backfill trench in accordance with Section 02225 of this specification package.

B. Installation of Pipe and Valves: Carbon steel, fittings, valves in clean outs, air release valves and lift station.

1. See Section 15060 for materials and installation.

C. Installation - Guard Post

1. Excavate for post and concrete in accordance with Section 02200.
2. Hand trim and remove loose material in excavation.
3. Position pipe in hole, maintaining clearances as specified on drawings.
4. Place concrete around and in pipe in accordance with Section 03001.
5. Paint post after concrete cures in accordance with ODOT Item 514.

D. Shop and Field Painting Specification:

For Steel Plate and Shapes, Pipe and Fittings

1. Prepare surfaces in accordance with Steel Structures Painting Council (SSPC) SP-6.
2. Prime all bare metal not in contact with concrete/grout with one coat Tnemec Series 6 Epoxo Line Primer. Apply two-coats of Tnemec Series 66 Hi-Build Epoxoline for the finish coat. Follow SSPC Paint 13 and Paint 20.

- E. For concrete installation at manholes, thrust blocks, and valves, see Section 03001.

### 3.4 FIELD QUALITY CONTROL

- A. Perform hydrostatic tests on carrier lines in accordance with AWWA C600. The allowable leakage rate for the carrier line testing is zero. Notify FDF at least 24 hours in advance of planned testing. Submit report to FDF within one week after completion of test.
- B. Perform pneumatic tests on all containment lines in accordance with manufacturer's recommendation. Subcontractor may perform hydrostatic testing on containment lines in lieu of pneumatic testing in accordance with the manufacturer's recommendation. Provide a mechanism to remove all trace water in the containment line if hydrostatic testing is chosen. The allowable leakage rate for the containment line testing is zero. Notify FDF at least 24 hours in advance of planned testing. Submit report to FDF within one week after completion of test.
- C. Each HDPE manhole shall be hydrostatically or pneumatic tested before and after installation by the following method:
1. Hydrostatic:
    - a. The manhole filled with potable water to within 6 inches of top.
    - b. Monitor the water level for a four hour period. The water level should not drop during this time period. Retest manhole until acceptable and drain.
  2. Pneumatic: Tested in accordance with manufacturer's recommendation.

END OF SECTION

SECTION 02669  
DISCHARGE LINE AND TREATMENT LINE

**PART 1      GENERAL**

**1.1          SECTION INCLUDES**

- A.      Pipe and fittings for underground discharge line and treatment line.
- B.      Valves and tap connections.
- C.      Air-relief manholes, frames, and lid.
- D.      Clean-outs.

**1.2          RELATED SECTIONS**

- A.      Section 01000 - General Requirements.
- B.      Section 01011 - Submittals.
- C.      Section 02200 - Non Impacted Material Earthwork.
- D.      Section 03001 - Concrete.

**1.3          REFERENCE DRAWINGS**

- A.      See Section 01012 for the Schedule of Drawings.

**1.4          REFERENCES**

- A.      American Society for Testing and Materials (ASTM):
  - 1.      ASTM D3035-95      Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
  - 2.      ASTM D3261-95      Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

3. ASTM D3350-96 Standard Specification for Polyethylene Plastic Pipe and Fittings Material.

B. American Water Works Association (AWWA):

1. AWWA C104/  
A21.4-95 Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2. ~~AWWA C105/  
A21.5-93~~ Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110/  
A21.10-93 Ductile-Iron and Gray-Iron Fittings, 3-Inch through 48-Inch, for Water and Other Liquids.
4. AWWA C111/  
A21.11-95 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
5. AWWA C115/  
A21.15-94 Flanged Ductile Iron Pipe with Threaded Flanges.
6. AWWA C150/  
A21.50-91 Thickness design of Ductile Iron Pipe.
7. AWWA C151/  
A21.51-91 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
8. AWWA C500-93 Metal-Seated Gate Valves for Water Supply Service.
9. AWWA C504-94 Rubber-seated Butterfly Valves.
10. AWWA C512-92 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
11. AWWA C600-93 Installation of Ductile-Iron Water Mains and Their Appurtenances.
12. AWWA C906-90 Polyethylene (PE) Pressure Pipe and Fittings, 4-Inch through 63-Inch, for Water Distribution.

**1.5 SUBMITTALS**

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, accessories, and the methods and equipment for HDPE fusion welding, HDPE manholes, and manhole frame and cover.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. As-built drawings in accordance with Section 01050.

**1.6 QUALITY ASSURANCE**

- A. Piping and Valves: Manufacturer's name and pressure rating marked on valve body.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect, and handle products to construction site.
- B. Deliver and store valves in shipping containers or pallets with labeling in place.

**PART 2 PRODUCTS****2.1 MATERIALS**

- A. Pipe
  - 1. Ductile Iron Pipe: AWWA C151, Class 55:
    - a. Fittings: AWWA C110, Ductile iron cement lined, standard thickness per AWWA C150. All fittings and pipe at valves shall be flanged per AWWA C115.
    - b. Jackets: AWWA C105, PE encasement.
    - c. Cement Lined: AWWA C104, cement mortar lined.
  - 2. High-Density PE Pipe: AWWA C906 (PE 3408), ASTM D3035, SDR 11 for 150 psi pressure rating (150 psi test pressure rating).
    - a. Fitting: AWWA C906, molded, butt fusion weld to pipe.

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- b. Joints: Butt fusion, flanged gasket joints, and molded adapter pipe at interface connections with ductile iron pipe and valves.
- c. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering.

B. Gate Valves

- 1. AWWA C500, ~~iron body, bronze trim, non-rising stem~~ with square nut, single wedge, Class 125 flanged ends, control rod, extension box, and valve key.

C. Bedding shall be in accordance with Section 02225.

D. Manhole: HDPE, ASTM D3350. Pipe resin is cell classification 3454-34C.

E. Manhole frame and lid shall be heavy-duty cast iron as noted on the drawings.

F. Air Release Valve: Valve shall be screwed inlet connection and shall be cast iron body, top, and inlet flange, stainless steel float and trim with BUNA-N seat to meet AWWA C512.

G. Post Indicating Valves: Post Indicating Valves Assembly - U.L. listed and FM approved.

- 1. Sizes 4 inches - 14 inches, AWWA C500 gate valves, flanged ends Class 150, post assembly shall show open and shut, handcrank operator above ground, non-rising stem, and break-flange to separate the top works without removing the valve from the line.

2.2 ACCESSORIES

A. Concrete: 3,000 psi (minimum) as specified in Section 03001.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

Verify existing conditions. Bring any discrepancies to FDF, in writing, for resolution prior to start of work.

**3.2 PREPARATION**

- A. Ream pipe and tube ends and remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare pipe connections to equipment by using flanges or unions.
- D. Excavate pipe trench in accordance with Section 02225. Locate existing utilities in the area and determine if they will interfere with the proposed utility. Notify FDF if there is an interference.
- E. Remove existing pipe to the extent necessary to make new tie ins. Tie-in locations shall be adjusted to conform to field conditions.

**3.3 ERECTION/INSTALLATION/APPLICATION**

- A. Installation - Pipe: Ductile Iron Pipe
  - 1. Install pipe to indicated elevation to within tolerance of 5/8 inches at structures.
  - 2. Install ductile iron piping and fittings to AWWA C600.
  - 3. Route pipe in straight line except as shown on drawing.
  - 4. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendations.
  - 5. Slope water pipe and position drain at low points.
  - 6. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main, except large radii bends.



7. Establish elevations of buried piping to ensure not less than 3.5 feet of cover.
8. Backfill trench in accordance with Section 02225.

**B. Installation - Pipe: HDPE**

1. Install pipe to indicated elevation to within tolerance of 5/8 inches at structures.
2. Install HDPE piping and fittings to AWWA C906 (by butt weld fusion method, in accordance with ASTM D3261).
3. Route pipe in line as shown on drawing.
4. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendation.
5. Install access fittings to permit cleanout.
6. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main.
7. Establish elevations of buried piping to ensure not less than 3.5 feet of cover. Five feet of cover is required when pipe is within 100 feet of the toe of the active Fly Ash pile.
8. Install trace wire continuous over top of pipe, buried 6 inches below finish grade, above pipe line; coordinate with Section 02225.
10. Backfill trench in accordance with Section 02225.

**C. Installation - Valves:**

1. Set valves on solid bearing of concrete.
2. Center and plumb valve box over valve. Set box cover flush with finished grade.

**3.4 FIELD QUALITY ASSURANCE**

- A. Perform hydrostatic tests on water line in accordance with AWWA C600 and Section 15060. Notify FDF at least 24 hours in advance of planned testing. Submit report within 1 week after completion of test.
- B. The new pipes shall be hydrostatically tested prior to tie-in. The test shall be run at 50 psi above the working pressure of the water main and hold within specifications for 2 hours.

$$\text{Allowable Leakage} = \frac{LD\sqrt{p}}{498,168}$$

L = Length of Pipe in Test in Feet

D = Diameter of Pipe in Inches

p = Test Pressure (operating Pressure + 50 psi = 110 psi + 50 psi)

Answer = Allowable Leakage in Cubic Feet over a 2-Hour Period.

Unless otherwise instructed by FDF, use 100 psi as the operating pressure for testing purposes.

END OF SECTION

SECTION 02713  
GEOMEMBRANE LINER

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Geomembrane materials, manufacture, fabrication, and installation of a geomembrane liner on the stormwater retention basin bottom and side slopes, ditches and underneath the Non Impacted Material Stockpiles.
- B.      Geotextile material as specified in Section 02270.
- C.      Use of geosynthetics for erosion control is specified in Section 02270.

**1.2      RELATED SECTIONS**

- A.      Section 01000 - General Requirements.
- B.      Section 01011 - Submittals.
- C.      Section 02200 - Non Impacted Material Earthwork.
- D.      Section 02270 - Erosion and Sediment Control.
- E.      Section 02720 - Site Drainage and Water Management.

**1.3      REFERENCE DRAWINGS**

- A.      See Section 01012 for the Schedule of Drawings.

**1.4      REFERENCES**

- A.      American Society for Testing and Materials (ASTM):
  - 1.      ASTM D638-96      Standard Test Method for Tensile Properties of Plastics.
  - 2.      ASTM D746-95      Standard Test Method for Brittleness Temperature of

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|                         | Plastics and Elastomers by Impact.  |
| 3. ASTM D1004 REV A -94 | Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.  |
| 4. ASTM D1204-94        | Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperatures.                            |
| 5. ASTM D1505-85        | Standard Test Method for Density of Plastics by the Density-Gradient Technique.   |
| 6. ASTM D4437-84        | Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.                               |
| 7. ASTM D5321-92        | Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method. |

B. Federal Test Method Standard (FTMS):

- |                 |   |
|-----------------|---|
| 1. FTMS 101B-71 | Method 2065, Puncture Resistance and Elongation Test. |
|-----------------|---|

C. United States Environmental Protection Agency (US EPA):

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|---|---|
| 1. US EPA Technical Guidance Document EPA/600/2-88/052  | Lining of Waste Containment and Other Impoundment Facilities, 1988.             |
| 2. US EPA Technical Guidance Document EPA/530/SW-91/051 | Inspection Techniques for the Fabrication of Geomembrane Field Seams, May 1991. |

D. Geosynthetics Research Institute (GRI):

- |                        |   |
|------------------------|---|
| 1. GRI Test Method GM6 | Standard Practice for Pressurized Air Channel Test for Dual Seamed Geomembranes, latest revision. |
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- E. National Sanitation Foundation (NSF):
  - 1. Standard Number Flexible Membrane Liners.  
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## 1.5 DEFINITIONS OF TERMS

- A. Manufacturer: The manufacturer is the firm or corporation responsible for production of the finished rolls of geomembrane material from raw material polymer to be used in the project. The manufacturer is responsible for the condition of the geomembrane until the material is accepted by the Construction Manager or his/her field representative upon delivery. The manufacturer shall produce a consistent product meeting the project specifications and shall provide quality control documentation for the product specified herein.
- B. Liner Subcontractor: The Liner Subcontractor is the firm responsible for installation of the geomembrane. The Liner Subcontractor shall be the manufacturer or an approved installer trained and certified to install the manufacturer's geomembrane. The Liner Subcontractor shall provide an Installation Supervisor responsible for the field crew.
- C. Film Tear Bond (FTB): A failure in the ductile mode of one of the bonded sheets by testing prior to complete separation to the bonded area as depicted in US EPA Technical Guidance Document EPA/600/2-88/052. A seam shall be classified as a FTB if no greater than 10 percent of the seam width peels (separates) at any point.
- D. Geomembrane: A synthetic lining material, also referred to as a flexible membrane liner (FML).

## 1.6 QUALITY ASSURANCE PROGRAM

- A. A laboratory shall be maintained by the manufacturer of the geomembrane materials at the point of manufacture to ensure quality control in accordance with ASTM and FTMS testing procedures (referenced in Section 1.4, as

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applicable). That laboratory shall maintain records of its quality control results and provide to Flour Daniel Fernald (FDF), prior to shipment, a Certificate of Compliance stating that all rolls of geomembrane material supplied are in compliance with specification physical properties requirements.

- B. The certificate shall include the name of the manufacturer, chemical composition, product description, statement of compliance to specification physical properties requirements, and the signature of authorized official attesting to the information required.
- C. Testing of factory fabricated seams for geomembrane shall be performed by the manufacturer. The manufacturer shall inspect and test 100 percent of factory fabricated seams in accordance with these specifications.
- D. Testing of geomembrane materials during construction will be performed by subcontractor. Subcontractor shall achieve and maintain an angle of internal friction of 10 degrees or greater between the geomembrane liner and infiltration barrier. Confirmation of the internal angle of friction results shall be provided to FDF. A minimum of 3 tests shall be performed using representative material from the top third, middle third, and bottom third of the stockpile. Preparation of soils to be tested shall follow moisture and compaction requirements as specified per infiltration barrier material, Specification Section 02200. Each test shall be performed at 3 loads (1, 2, and 4 psi) with a shearing rate of 0.040 inches per minute. Testing work shall be performed prior to ordering specified geomembrane.
- E. Geomembrane shall be randomly sampled and tested in accordance with the manufacturer's approved QC manual. Samples not meeting the minimum requirements specified shall result in the rejection of the applicable sheets.

- F. The Liner Subcontractor shall have installed a minimum of 1 million ft<sup>2</sup> of High-Density Polyethylene (HDPE) geomembrane.
- G. The Installation Supervisor shall have demonstrated experience in installing and seaming of a minimum of 500,000 ft<sup>2</sup> of HDPE geomembrane liner systems for similar applications. The Installation Supervisor shall remain on site and be responsible for the liner layout, seaming, patching, repairs, testing coordination with FDF, and all other activities associated with installation of the geomembrane.

#### 1.7 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Submit samples of the proposed geomembrane.
- C. Submit a Certificate of Compliance from the manufacturer in accordance with Part 6 of the Contract Documents for the geomembrane material.
- D. Submit quality control certificates issued by the producer of the raw materials used to manufacture the geomembrane. These certificates shall include the following.
  - 1. Origin, identification, and production plant location of the resin used to manufacture the geomembrane.
  - 2. Reports of testing conducted to verify the quality of the resin including the stabilization compounds used to manufacture the geomembrane, with signature of authorized official. Properties testing typically performed by the resin manufacturer shall be included in the reports.
- E. Shop Drawings: Submit shop drawings showing proposed geomembrane panel layout, panel size, shop and field seams, and location of test coupons. The drawings shall include number or letter or panels and cross-reference surrounding panels, details of seaming the geomembrane, connections, penetrations, pipe boot

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fabrication, and other construction related details. Shop drawings shall be prepared in accordance with Part 6 of the Contract Documents.

- F. As-builts: Submit as-built drawings showing geomembrane panel layout, panels size, seam type and location, location of test coupons, and areas where repairs were made. Drawings shall be prepared in accordance with Part 6 of the Contract Documents.
- G. Submit inspection and testing data for factory fabricated seams.
- H. Submit geomembrane manufacturer's quality control manual including description of laboratory facilities.
- I. Submit results of the manufacturer's physical properties testing in accordance with the approved QA Manual. Testing shall include, but not be limited to, the typical properties outlined in Table 1.
- J. Submit test results for internal friction testing, ASTM D5321.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Each roll of geomembrane shall be marked to show the following minimum information:
  - 1. Name of manufacturer.
  - 2. Product type.
  - 3. Physical dimensions (length and width).
  - 4. Roll identification number.
- B. The Liner Subcontractor shall review, inspect, and place into proper storage all materials received on site until their installation. All such materials shall be inspected to verify their conformance with the requirements of these specifications and that they are free of defects. Any nonconforming or defective materials shall be clearly marked and promptly repaired per approved procedure or removed from the job site.



- C. When the geomembrane materials are delivered to the construction site, FDF, or designated representative, will inspect to confirm that the material is the material that was specified and that the material is not damaged. Inspection activities shall prevent, detect, and correct the following:
1. Puncture from nails or splinters.
  2. Tears from operation of equipment or inadequate packaging.
  3. Blocking (the bonding together of adjacent membrane layers), which may be caused by excessive heat.
  4. Crumpling or tearing from inadequate packaging support.
- D. Handling
1. Palletted geomembrane panels shall be accordion folded width-wise and length-wise without causing damage to the geomembrane.
  2. Banding straps around the geomembrane and pallet shall be properly cushioned so as not to cause damage to any part of the geomembrane panel.
  3. The stacking of palletted geomembrane panels on top of one another is not permitted.
  4. Damage shall be avoided by careful handling of the geomembrane material during preparation for shipment and of the packaged crates and rolls of material.
  5. When damage to a crate or roll cover has occurred, careful examination of the underlying material is required. If damage is found, the Liner Subcontractor and FDF should carefully examine the entire shipment for damage.
- E. Storage: Sufficient quantities of materials shall be stockpiled to meet project schedule and requirements. Materials shall be stored on site at locations designated by FDF.
- F. The Liner Subcontractor shall be responsible for unloading, storage, and care of the geomembrane material until such material has been incorporated into the work. Materials shall be stored in a manner that

prevents damage in accordance with the manufacturer's recommendations. The materials shall be stored on a prepared surface (excluding wooden pallets) and shall not be stacked more than two rolls high.

- G. The Liner Subcontractor shall be responsible for replacing any damaged or unacceptable material at no expense to FDF.

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## 1.9 SEQUENCING AND SCHEDULING

- A. The Liner Subcontractor shall provide a sequence and schedule of work for the approval of FDF.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. HDPE liner shall be **Frictionflex**, by GSE Lining Technologies Systems Inc., equivalent products by SERROT Corp., POLY-FLEX Corp., National Seal Company, or other approved equal.
- B. Materials manufactured by others may be submitted to FDF for consideration.

### 2.2 EQUIPMENT

- A. The Liner Subcontractor shall use appropriate installation and welding equipment per the manufacturer's instructions.
- B. Welding Equipment: The welding equipment used shall be capable of continuously monitoring and controlling the extrusion/fusion zone. The fillet-extrusion welding device provides continuous dynamic integration of the extrudate into the sheet material through the means of rotating tips in the nozzle. The composition of the extrudate (welding rod) is identical to the flexible membrane liner. This method of seaming is applied for all tees, patches, "fishmouths," and detail work. The fusion welding device employs a dual hot wedge (hot shoe) and compression. The system lifts both layers of

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## C. Typical Physical Properties:

Table 1 - Typical Geomembrane Physical Properties

Typical Properties	Test Method	Gage (Nominal) 60 mil (1.5 mm) HDPE
Density g/cc. (Min.)	ASTM D1505	0.94
Tensile Properties (Typical)	ASTM D 638 Type IV Dumb Bell at 2 ipm	
1. Tensile Strength at Break (Pounds/inch width)		300
2. Tensile Strength at Yield (Pounds/inch width)		144
3. Elongation at Break (Percent)		800
4. Elongation at Yield (Percent)		15
Tear Resistance Initiation, lbs. (Typical)	ASTM D1004 Die C	50
Low Temperature Brittleness, F (Typical)	ASTM D746 Procedure B	-120
Dimensional Stability, Percent Change Each Direction (Max.)	ASTM D1204 212 degrees F 1 hr.	±1
Puncture Resistance, Pounds (Typical)	FTMS 101B Method 2065	90

## 2.4 FACTORY FABRICATION

- A. Geomembrane liner shall be factory seamed into panels as large as possible for transportation and for the areas to be lined. Geomembrane liner for ditches should be factory seamed and transported as one piece if possible.
- B. Factory fabrication shall be performed under environmental conditions as recommended by the manufacturer.

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C. Typical Physical Properties:

Table 1 - Typical Geomembrane Physical Properties

Typical Properties	Test Method	Gage (Nominal) 60 mil (1.5 mm) HDPE
Density g/cc. (Min.)	ASTM D1505	0.94
Tensile Properties (Typical)	ASTM D 638	
1. Tensile Strength at Break (Pounds/inch width)	Type IV Dumb Bell at 2 ipm	300
2. Tensile Strength at Yield (Pounds/inch width)		144
3. Elongation at Break (Percent)		800
4. Elongation at Yield (Percent)		15
Tear Resistance Initiation, lbs. (Typical)	ASTM D1004 Die C	50
Low Temperature Brittleness, F (Typical)	ASTM D746 Procedure B	-120
Dimensional Stability, Percent Change Each Direction (Max.)	ASTM D1204 212 degrees F 1 hr.	±1
Puncture Resistance, Pounds (Typical)	FTMS 101B Method 2065	90

2.4 FACTORY FABRICATION

- A. Geomembrane liner shall be factory seamed into panels as large as possible for transportation and for the areas to be lined. Geomembrane liner for ditches should be factory seamed and transported as one piece if possible.
- B. Factory fabrication shall be performed under environmental conditions as recommended by the manufacturer.

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- C. The geomembrane material shall be continuously inspected for uniformity, damage, imperfections, holes, cracks, thin spots, foreign materials, tears, punctures, and blisters. Any imperfections shall be immediately repaired and reinspected.
- D. All seams shall be visually inspected and results documented.
- E. Nondestructive seam testing shall be performed on all fabricated seams over their full length in accordance with ASTM D4437 and the manufacturer's quality control manual. Test methods shall be vacuum chamber or pressurize air channel, except air lance may be used on inaccessible seams.
- F. All inspection and testing of factory seams shall be performed by the manufacturer's laboratory.
- G. Failure of the material and/or seams to meet all the requirements of these specifications may be cause for rejection of the geomembrane material and/or seams, as appropriate.
- H. In addition to visual inspection and nondestructive testing, a 48-inch sample shall be taken from each factory seam welding unit used in this work at the beginning of every work shift and every 4 hours of production thereafter. Samples shall be from the same production lot as the field panels (i.e., will not require patching of fabricated panels). Test specimens shall be cut at quarter points from each 48-inch seam sample (a total of three places) and tested for factory seam shear strength and peel adhesion. The seam shear strength shall be tested in accordance with ASTM D4437, as modified in Annex A of NSF 54, and shall have a tensile strength of at least 90 percent of the parent geomembrane strength. Failure of seam shall be classified as FTB. The peel adhesion shall be tested in accordance with ASTM D4437, as modified in Annex A of NSF 54, and shall provide a peel strength that is greater than 60 percent of the parent geomembrane yield strength. Failure of seam shall be classified as FTB.

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**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. The earthen surface shall be smooth and true to grade with no exposed rocks, stones, sticks, roots, or other sharp objects or debris of any kind larger than 2" in any direction.
- B. Before starting installation of the liner, the Liner Subcontractor shall inspect the substrate for suitability with the requirements of the liner. The liner installer shall certify in writing that the surface on which the membrane is to be installed is acceptable before commencing work.
- C. During the time of liner installation, the Liner Subcontractor shall be responsible for protection and maintenance of the exposed subgrade until final acceptance of the liner.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Verify gradients and elevation of sub-base.
- B. Verify that subgrade is dry.
- ~~C. Install geotextile on prepared subgrade in Non Impacted Material Stockpile locations in accordance with the Construction Drawings prior to geomembrane liner installation. Geotextile installation shall be in accordance with the Construction Drawings and manufacturer's recommendations. Geotextile as specified in Section 02270.~~
- C.** Geomembrane liner shall be placed and anchored in such a manner that fabric will not excessively stretch or tear.
- D.** Appropriate measures shall be taken during installation to provide sufficient slack in the liner to avoid the generation of excessive stresses in the liner due to temperature changes.

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**E.** Field seams shall be made using either the dual hot wedge (fusion) welding or the fillet-extrusion welding process (for areas not accessible with the dual hot wedge method). Field seams shall be made only when weather conditions are favorable. The contact surfaces shall be free of dirt, dust, moisture, or other foreign material. The contact surfaces shall be aligned with sufficient overlap and bonded in accordance with the liner manufacturer's recommended procedures. Wrinkles shall be smoothed out, and seams shall be inspected by nondestructive testing techniques to verify their integrity.

**F.** Deployment

1. The geomembrane shall be deployed following the manufacturer's recommendations so that, at the time of installation, it will contain a minimum of wrinkles and be under minimum stress.
2. Each panel/roll of the geomembrane shall be rolled out and installed in accordance with the approved shop drawings. The layout shall be designed to keep field joining of the geomembrane to a minimum and to be consistent with proper methods of geomembrane installation.
3. The geomembrane shall be unfolded or unrolled so as to prevent damage to the underlying or prepared subgrade or geotextile.
4. Should punctures, rips, or tears be encountered in the geomembrane material, the Liner Subcontractor shall immediately notify FDF and repair as necessary.

**G.** Seaming Weather Conditions

1. Normal Weather Conditions
  - a. The normal required weather conditions for seaming are as follows:
    - 1) Ambient temperature as recommended by the manufacturer.
    - 2) No precipitation or other excessive moisture, such as fog, dew, or ponded water.
    - 3) No excessive winds.

- b. These weather conditions shall be fulfilled during seaming process.
- 2. Cold Weather Conditions
  - a. If the ambient temperature is below 40 degrees F, seaming of geomembrane shall not be permitted unless the Liner Subcontractor can demonstrate to FDF's satisfaction that geomembrane seam quality is not adversely impacted. ~~The following conditions shall~~ also be met to ensure a quality seaming process:
    - 1) Preheating the surface of the geomembrane to achieve normal temperature range.
    - 2) Preheating may be waived by FDF if the Liner Subcontractor demonstrates that satisfactory welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
    - 3) Preheating devices shall be approved by the manufacturer.
    - 4) Care shall be taken to ensure that surface temperatures are not lowered below the minimum required surface temperature for welding due to winds.
    - 5) Additional destructive test samples shall be taken at FDF's discretion.
    - 6) Trial seams shall be performed under the same ambient temperature conditions as the actual seams.
- 3. Warm Weather Conditions
  - a. If the ambient temperature is above 104 degrees F, seaming of geomembrane shall not be permitted unless the Liner Subcontractor can demonstrate to FDF's satisfaction that geomembrane seam quality is not adversely impacted.
  - b. Test seams shall be performed under the same ambient temperature conditions as the actual seams.
  - c. Additional destructive test samples shall be taken at FDF's discretion.

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H.

## Field Seaming

1. Panel field seaming shall be performed using the dual hot wedge welding techniques as outlined in Section 7 of US EPA Technical Guidance Document EPA/530/SW-91/051. Welding equipment and seaming temperatures shall be in accordance with the manufacturer's recommendations.
2. Field seams shall be oriented parallel to the line of maximum slope.
3. Unless directed otherwise by FDF, minimum overlap for field seams shall be in accordance with the manufacturer's recommendations.
4. The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the lining material to ensure that changes in environmental conditions will not affect the integrity of the weld.
5. Welding of field seams with an extrusion welder is only acceptable for repairing holes in the liner, repairing failed seams revealed by nondestructive testing, repairing areas where destructive testing is performed, at pipe/liner penetration boots, and other areas where the hot wedge welding machines cannot be used due to space restrictions.

I.

The liner shall be placed over the prepared surface in such a manner as to ensure minimum handling. The geomembrane shall not be dragged over rough subgrade surfaces. Any damage to the base surface resulting from liner installation or liner handling equipment shall be repaired by the Liner Subcontractor at its own expense prior to placement of the liner. Vehicular traffic across the geomembrane shall not be allowed. The panels shall be such lengths and widths and shall be placed in such a manner as to minimize field seaming.

J.

In areas where wind is prevalent, liner installation shall be started at the upwind side of the project and proceed downwind. The leading edge of the liner shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

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K. Sandbags shall be used as required to hold the liner in position during installation. Materials, equipment, or other items shall not be dragged across the surface of the liner nor be allowed to slide down slopes on the liner.

L. Liner panels shall be closely fit and sealed around inlets, outlets, and other projections through the liner. All piping, structures, and other projections through the liner shall be sealed as shown on the Construction Drawings.

M. All joints shall be tightly bonded on completion of the work. Any liner surface showing injury resulting from scuffing, penetration by foreign objects, or distress from rough subgrade shall be repaired or replaced as approved by FDF.

N. Each suspect location shall be nondestructively tested using methods described in Section 1.4 as appropriate. The Liner Subcontractor shall not proceed with any materials which will cover locations that have been repaired until satisfactory test results have been obtained.

O. Pipe/Liner Penetration Boots

1. The geomembrane boots shall be furnished and installed where indicated on the Construction Drawings.
2. The geomembrane boots shall terminate in a skirt section suitable for welding to the geomembrane.
3. Boots and skirts shall fit snugly around the pipe or power pole. Prefabricated material shall be designed to fit site-specific conditions for the intended size and slope of pipe.
4. The geomembrane shall be secured to the pipe or power pole with clamps as shown on the Construction Drawings after pipe/liner penetration boots have been tested.

P. Any wrinkles that can fold over shall be repaired either by cutting out excess material or, if possible, allowing the liner to contract due to temperature



1. Two types of samples shall be taken at each location, one for field tests and one for laboratory tests.
2. For the field tests, two seam samples, 1 inch wide by 12 inches long with the seam centered across the length shall be taken 42 inches apart. These sample coupons shall be removed by the Liner Subcontractor for every 500 feet of seam length. A minimum of three samples shall be tested, including at least one for each day's production seaming.
3. Upon obtaining each sample, assign a number to the sample and mark it accordingly. Record sample location on the layout drawing. Record the purpose of the sample (i.e., statistical, routing, or suspicious weld area).
4. These samples shall be tested in the field using a tensiometer capable of quantitatively measuring shear and peel strengths.
5. The sample coupon shall be divided into three equal parts: one part for laboratory testing, one part to the Construction Manager for archive storage, and one part to the Liner Subcontractor for field testing. The sample coupon shall be tested in the testing laboratory for shear strength and peel adhesion.

## Repair Procedures

1. Any portion of the geomembrane failing a destructive test, nondestructive test, or any damaged portion shall be repaired in accordance with this section and the manufacturer's recommendations.
2. All surfaces shall be clean and dry at the time of the repair.
3. The repair procedures, materials, and techniques shall be approved in advance of the specific

repair by FDF. Approved methods from which the selected repair shall be chosen are as follows:

- a. Patching - used to repair large holes, tears, large panel defects, and destructive sample locations.
  - b. Capping - used to repair failed welds or to cover seams where welds cannot be nondestructively tested.
  - c. Removal - used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles) from the installed geomembranes.
4. If a sample fails one of the destructive tests, the seam shall be reconstructed using one of the following methods:
    - a. The seam shall be reconstructed between the location of the sample which failed and the location of the next passing sample in each direction.
    - b. The welding path is retraced to an intermediate location at least 10 feet from the location of the failed sample and a second sample is taken for additional testing. If the second test sample passes, the seam shall then be reconstructed between the location of the second test and the original sampled location. If the second test fails, this process shall be repeated.
  5. All acceptable seams shall extend between two locations where samples passed the required test and shall include one test location along the reconstructed seam.
  6. Each major repair requiring a patch or cap shall be identified on the as-built drawing.
  7. Each repair shall be numbered and logged by the Liner Subcontractor. Each repair shall be nondestructively tested using methods described in this section. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 100 feet long may be sufficient to require destructive test sampling, at FDF's discretion.

Failed tests indicate that the repair shall be redone and retested until passing test results are achieved. FDF shall observe all nondestructive testing of repairs. The Liner Subcontractor shall record the number of each repair, the test location, date, and test outcome.

### 3.3 QUALITY CONTROL

- A. General: The Liner Subcontractor shall conduct a fully documented quality assurance/quality control program to ensure that all installation work is performed which will result in a secure, watertight liner. All quality control inspection and testing shall be performed by qualified personnel who are thoroughly knowledgeable about all installation procedures and techniques used. Three copies of all inspection and test reports generated by the Liner Subcontractor shall be submitted to FDF not later than the second work day following their generation. As a minimum, the Liner Subcontractor shall provide written verification of the results of all of the following inspections and tests.
- B. Weld Quality Control
1. A trial seam, 3 feet long, from each welding machine shall be run each day prior to liner seaming and under the same conditions as exist for the liner seaming. Additionally, at least once every 4 hours during continuous operation.
    - a. Samples of seam shall be cut from the test weld 1/4 inch to 1/2 inch wide and tested by field tensiometer in the peel and shear modes.
    - b. Should failure of the seam occur, another trial seam shall be prepared and tested. If the additional sample fails, the seaming apparatus and seamer shall not be accepted until deficiencies are corrected.
    - c. The trial seam shall be marked with the time of day, date, ambient temperature, and welding machine used in its production.
    - d. The seam sample shall be kept for subsequent testing on laboratory tensiometer equipment

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in accordance with the applicable ASTM D1004 and D4437 tests. If either sample fails through the weld, the welding machine shall be adjusted as appropriate and another test weld produced and tested until satisfactory results are achieved. A calibrated, hand-operable tensile testing machine shall be furnished by the Liner Subcontractor for the purpose of tensile testing.

2. All welds, on completion of the work, shall be tightly bonded. Any membrane area showing injury due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of HDPE membrane.
3. A quality control technician, employed by the Liner Subcontractor, shall follow behind each seam crew and perform a visual inspection of the seamed area. Defective seams shall be marked and repaired in accordance with manufacturer's published repair procedure.
4. No "fishmouths" shall be allowed within the seam area. Where "fishmouths" occur, the material shall be cut and overlapped, and an overlap-extrusion weld shall be applied.

C. Nondestructive Testing: All field seams (100 percent) shall be tested nondestructively. Fillet-extrusion welds are tested with a vacuum chamber in accordance with ASTM 4437. Hot wedge welds shall be dual seam pressure tested, pressurizing the air channel created by the split face design of the hot wedge per GRI GM-6.

D. Destructive Seam Testing

1. Two types of samples shall be taken at each location, one for field tests and one for laboratory tests.
2. For the field tests, two seam samples, 1 inch wide by 12 inches long with the seam centered across the length shall be taken 42 inches apart. These sample coupons shall be removed by the Liner Subcontractor for every 500 feet of seam length, unless more frequent testing is required by FDF. A minimum of three samples shall be tested,

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including at least one for each day's production seaming. The seams shall not be covered by another material before they have been tested and accepted by FDF.

3. Upon obtaining each sample, assign a number to the sample and mark it accordingly. Record sample location on the layout drawing. Record the purpose of the sample (i.e., statistical, routing, or suspicious weld area).
4. These samples shall be tested in the field using a tensiometer capable of quantitatively measuring shear and peel strengths.
5. The sample coupon shall be divided into three equal parts: one part for laboratory testing, one part to the Construction Manager for archive storage, and one part to the Liner Subcontractor for field testing. The sample coupon shall be tested in the testing laboratory for shear strength and peel adhesion.

E. Repair Procedures

1. Any portion of the geomembrane failing a destructive test, nondestructive test, or any damaged portion shall be repaired in accordance with this section and the manufacturer's recommendations.
2. All surfaces shall be clean and dry at the time of the repair.
3. The repair procedures, materials, and techniques shall be approved in advance of the specific repair by FDF. Approved methods from which the selected repair shall be chosen are as follows:
  - a. Patching - used to repair large holes, tears, large panel defects, and destructive sample locations.
  - b. Capping - used to repair failed welds or to cover seams where welds cannot be nondestructively tested.
  - c. Removal - used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles) from the installed geomembranes.

4. If a sample fails one of the destructive tests, the seam shall be reconstructed using one of the following methods:
  - a. The seam shall be reconstructed between the location of the sample which failed and the location of the next passing sample in each direction.
  - b. The welding path is retraced to an intermediate location at least 10 feet from the location of the failed sample and a second sample is taken for additional testing. If the second test sample passes, the seam shall then be reconstructed between the location of the second test and the original sampled location. If the second test fails, this process shall be repeated.
5. All acceptable seams shall extend between two locations where samples passed the required test and shall include one test location along the reconstructed seam.
6. Each major repair requiring a patch of cap shall be identified on the as-built drawing.
7. Each repair shall be numbered and logged by the Liner Subcontractor. Each repair shall be nondestructively tested using methods described in this section. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 100 feet long may be sufficient to require destructive test sampling, at FDF's discretion. Failed tests indicate that the repair shall be redone and retested until passing test results are achieved. FDF shall observe all nondestructive testing of repairs. The Liner Subcontractor shall record the number of each repair, the test location, date, and test outcome.

### 3.4 CLEANING

- A. Remove and manage excess materials in accordance with the Subcontract, Part 6, ~~Scope of Work.~~

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### 3.5 PROTECTION

- A. Provide protection from damage until anchorage and welding of seams has been accomplished and all testing and inspections are completed and ~~completion of subcontract final acceptance by FDF has been received.~~

END OF SECTION

SECTION 02720  
SITE DRAINAGE AND WATER MANAGEMENT

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Site storm drainage piping, gravity conveyance piping, fittings, accessories, and bedding.
- B. Site surface drainage and stormwater retention basins.
- C. Control of surface water and removal of ponded water from construction areas.
- D. Requirements for Water Management Plan including surface water and perched groundwater

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Non-impacted Material Earthwork.
- D. Section 02205 - Impacted Material Excavation and Handling.
- E. Section 02270 - Erosion and Sediment Control.
- F. Section 02667 - Drinking Water Lines.
- G. Section 03001 - Concrete.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

#### 1.4

#### REFERENCES

- A. State of Ohio, Department of Transportation, Construction and Material Specifications, January 1, 1997 (ODOT). Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.
- 
- B. American Society for Testing and Materials (ASTM):
1. ASTM D1248-84 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
  2. ASTM D2321-89 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Application.
  3. ASTM D3035-95 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
  4. ASTM F405-96 Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings.
  5. ASTM F477-95 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- C. American Water Works Association (AWWA):
1. AWWA C901-88 Polyethylene (PE) Pressure Pipe and Tubing 1/2-inch through 3-inch, for Water Systems.
  2. AWWA C906-90 Polyethylene (PE) Pressure Pipe and Fittings 4-inch through 63-inch, for Water Distribution.
- D. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M36-91 Standard Specification for Corrugated Steel Pipe,

2. AASHTO M294-94      Metallic-Coated, for Sewers  
and Drains.  
Specification for Corrugated  
Polyethylene Pipe, 12 to 36  
Inch Diameter Pipe.

## 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.
- B. Water Management Plan: Plans and details describing methods for storm water collection, run on control, points of discharge, and methods to protect exposed contaminated areas at end of day's work or during inclement weather for denuded slopes and excavations. The plan will be submitted to FDF for review and approval as part of the Safe Work Plan prior to initiation of construction.
- C. Provide as-built information in accordance with Section 01050.
- D. Test Reports: Test reports for all tests required under Field Quality Control.

## PART 2 PRODUCTS

### 2.1 PIPE MATERIALS

- A. Corrugated HDPE for West Pump Station Culvert Diversion
  - 1. Smooth interior, corrugated exterior high-density polyethylene pipe conforming to AASHTO M294 Type S pipe and fittings shall be made of polyethylene compounds that meet or exceed the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C per ASTM D1248 and ASTM F405.
  - 2. Fittings shall be factory made by the manufacturer of the pipe. No field fabricated fittings will be allowed.
  - 3. Coupling bands/sleeves shall be watertight, gasketed, bell type with an indentation in the center to ensure proper positioning of the pipe.

Coupling bands/sleeves shall be factory installed on one end of the pipe. Gaskets shall be a solid cross section ring conforming to ASTM F477.

4. Corrugated pipe, fittings, couplings bands/sleeves, gaskets and gasket lubricant shall be supplied by the manufacturer of the pipe.

**B. Corrugated Metal Pipe**

1. Corrugated metal storm pipe shall be in accordance with AASHTO M36 and ODOT 707. Corrugated metal drain pipe shall be galvanized, of the size and type specified on the construction drawings.
2. Storm drain pipe, culverts, and fittings as identified on drawing shall be corrugated steel, 14-gage thickness. Culverts shall have standard metal flared sections.
3. Coupling bands shall be corrugated, galvanized steel bands in accordance with AASHTO M36. Pipe sections with rerolled ends shall be joined with annular corrugated connecting bands. Helical corrugated pipe ends shall be joined using helical corrugated connecting bands.

**C. High-Density Polyethylene (HDPE) Pipe AWWA C906 (PE 3408), ASTM D3035 for wheel wash sump discharge line.**

1. Fitting: AWWA C901, molded.
2. Joints: Butt fusion, flanged gasket joints at interface connections with ductile iron pipe and valves.
3. Trace Wire: Magnetically detectable conductor, green.

**2.2 BEDDING AND COVER MATERIALS**

- A. Bedding: As specified in Section 02225.
- B. Cover: As specified in Section 02225.

**2.3 CONCRETE AND CONCRETE ACCESSORIES**

- A. Materials: Refer to Section 03001.

- B. All precast concrete shall meet the requirements of ODOT 706.13 with 5 1/2 percent air void content in the hardened concrete.

### PART 3 EXECUTION

#### 3.1 FIELD CONDITIONS

- A. Verify that excavation trenches are ready to receive work.

#### 3.2 PREPARATION

- A. Hand trim excavations. Correct over-excavation according to the requirements of Section 02225 of this specification package.

#### 3.3 INSTALLATION

##### A. General

1. If rock is encountered, the excavation shall be carried no less than 6 inches and no more than 12 inches below the bottom of pipe materials. Approved compacted material shall be used to backfill from rock excavation prior to installation.
2. All compacted backfill shall meet the requirements of unclassified backfill in accordance with Section 02225. Backfill compaction shall conform to the requirements of Section 02225.
3. See Section 02225 for the frequency of samples.
4. Excavation shall conform to Section 02225.

##### B. Installation of Corrugated Metal Pipe

1. The pipe and fittings shall be free of foreign inclusions and visible defects. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.
2. All pipe shall be laid as shown in the drawings.
3. Joints for corrugated metal pipe shall be made with corrugated galvanized steel coupling bands in accordance with AASHTO M36.

4. Paint welds, cuts and holes with a zinc based paint.
- C. The west pump station culvert diversion (north of the Inactive Flyash Pile) is to be extended as shown on the drawings. This extension is temporary. Subcontractor is to install extension and repair as necessary, including replacement if required.
- 
- D. See Section 02667 for installation of HDPE pipe joined by fusion welding. Install in accordance with ASTM D2321.
- E. Stormwater that is encountered during or collects in excavations is to be conveyed to the retention basins for conveyance to SWRB.
- F. In other construction areas stormwater control shall be achieved by gravity or by pumps. All methods shall be of sufficient capacity to maintain excavation work in the dry. Runon into work areas is to be minimized (i.e., grading and diversions).

### 3.4 FIELD QUALITY CONTROL

- A. Inspection:
1. Inspection shall include checking for proper alignment and location of all drainage pipe prior to backfill.
  2. All inspections shall have a report filed with FDF within one week after the test.
- B. Notify FDF of testing and/or inspection activities at least 24 hours prior to the start of all tests or inspections.
- C. Testing of backfill compaction shall be as specified in Section 02225.

END OF SECTION

SECTION 02831  
CHAIN LINK FENCES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Permanent fence framework, fabric, and accessories to be installed south of the South Field and near the Support Area as indicated on the construction drawings.
- B. Excavation for post bases; concrete foundation for posts and center drop for gates.
- C. Manual gates and related hardware.
- D. Fence repair, as needed, as a result of relocation or of Subcontractor's construction or site clearing activities.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02100 - Site Clearing.
- D. Section 02200 - Non-impacted Material Earthwork.
- E. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A121 Standard Specification for  
Rev. A-92 Zinc-Coated (Galvanized) Steel  
Barbed Wire.

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| 2. | ASTM A123<br>Rev. A-89 | Standard Specification for<br>Zinc (Hot-Dip Galvanized)<br>Coatings on Iron and Steel<br>Products.                  |
| 3. | ASTM A153<br>A153M-95  | Standard Specification for<br>Zinc Coating (Hot-Dip) on Iron<br>and Steel Hardware.                                 |
| 4. | ASTM A392<br>-96       | Standard Specification for<br>Zinc-Coated Steel Chain-Link<br>Fence Fabric.   |
| 5. | ASTM A570<br>A570M-95  | Standard Specification for<br>Steel, Sheet and Strip,<br>carbon, Hot-Rolled, Structural<br>Quality.                 |
| 6. | ASTM F567-93           | Standard Practice for<br>Installation of Chain Link<br>Fence.   |
| 7. | ASTM F669-92           | Standard Specification for<br>Strength Requirements of Metal<br>Posts and Rails for Industrial<br>Chain Link Fence. |
| 8. | ASTM F1234-93          | Standard Specification for<br>Protective Coating on Steel<br>Framework for Fences.                                  |

#### 1.5 SYSTEM DESCRIPTION

- A. Fence Height: 6 feet nominal (with three strands of barbed wire 1 foot high on extension arms, if applicable) as indicated on drawings.
- B. Line Post Spacing: At intervals not exceeding 10 feet.
- C. Fence Post and Rail Strength: Conform to ASTM F669.
- D. Gate Sizes: As shown on drawings.

#### 1.6 SUBMITTALS

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.

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- B. As-Built Drawings: Indicate plan layout, size, type, and swing of gates.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Framing (Steel): ASTM A570 zinc coated hot rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi. External surface triple coating per ASTM F1234, Type B and Type D with  $1.01 \pm 0.1$  ounce zinc per square foot and  $30 \pm 15$  micrograms of chromate per square inch. Coat internal surface after welding with a zinc-rich based organic coating (91 percent min. zinc powder).
- B. Fabric Wire (Steel): ASTM A392 zinc-coated, 9-gage wire fabric, 2-inch diamond mesh interwoven wire, top salvage twisted tight, bottom salvage knuckle end closed. Fabric wire on-site can be reused if approved by FDF.
- C. Barbed Wire: ASTM A121 galvanized steel; 12-gage wire, to match existing fence.
- D. Concrete: See Section 03001.
- E. Gates: Swing gates internally braced to prevent sag. Fabric equivalent to that of fence; secure to frame with tension bars and hook bolts. Extend top frame of gates vertically to provide three rows of barbed wire, if applicable. Fence fabric and rails may be reused if in sound condition. Reuse existing fence fabric, posts and fence accessories where possible.
- F. Components
1. Corner and Terminal Posts: 2-7/8 inch, outside diameter.
  2. Top and Brace Rail: 1-5/8 inch, outside diameter, plain end, sleeve coupled.
  3. Tension Wire: 6-gage galvanized steel, single strand.
  4. Tie Wire: 6-gage galvanized steel wire.
  5. Line Posts: 2-3/8-inch outside diameter.

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- 6. Gate Posts: 2-7/8-inch outside diameter.
- 7. Gate Frame: 1-7/8-inch diameter for welded fabrication.

## **2.2 ACCESSORIES**

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.
- C. Extension Arms: Cast steel galvanized, to accommodate three strands of barbed wire, single arm, sloped to 45 degrees up from horizontal.
- D. Gate Hardware: Hinges shall be galvanized, malleable iron hinges. Ball and socket bottom hinge to sustain gate weight. Install gate with a positive type latching device and padlocking capabilities and double gates with center plunger rod catches. Secure gates in open position with semiautomatic outer catches to secure gates in open position.
- E. Drive Anchor: Two angles, 36-inch length, 1-1/4 inches by 1-1/4 inches by 1/4 inch.
- F. Fasteners: Galvanized steel.

## **2.3 FINISHES**

- A. Components and Fabric: Galvanized to ASTM A123; 2.0 ounces/square feet coating.
- B. Hardware: Galvanized to ASTM A153, 2.0 ounces/square feet coating.
- C. Accessories: Same finish as framing.

**PART 3 EXECUTION****3.1 ERECTION/INSTALLATION/APPLICATION**

- A. Install framework, fabric, accessories, and gates in accordance with the manufacturer's instructions and ASTM F567.
- B. Set all posts plumb in accordance with details on the drawings. Where concrete footings are used, top of footing shall be 2 inches above finish grade. Slope top of concrete for water runoff.
- C. Brace gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end.
- D. Provide top rail through line post tops and splice with 6-inch long rail sleeves.
- E. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less, as per manufacturer's recommendations.
- F. Position bottom of fabric 1 inch above finished grade.
- G. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
- H. Attach fabric to end and corner posts with tension bars and tension bar clips.
- I. Install bottom tension wire stretched taut between terminal posts, as per manufacturer's recommendations.
- J. Install support arms sloped outward and attach barbed wire; tension and secure.
- K. Install gates plumb, level, and secure for full opening without interference. Adjust and lubricate hardware for smooth operation.

- L. Coat areas where the galvanized finish has been damaged, using zinc-enriched paint.
- M. Install grounding as noted on the details, in accordance with Section 16170.

### 3.2 FIELD QUALITY CONTROL

- 
- A. Erection Tolerances
    - 1. Maximum Variation from Plumb: 1/4 inch.
    - 2. Maximum Offset from True Position: 1 inch.
  - B. Patch, repair, or replace any material damaged by the Subcontractor to match undamaged material.

END OF SECTION

SECTION 02900  
SOIL PREPARATION AND SEEDING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Temporary and permanent seeding, fertilizing, and mulching to stabilize ~~soil stockpiles~~, disturbed areas, and denuded areas to remain undisturbed for more than 45 calendar days.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 02200 - Non-impacted Material Earthwork.  
D. Section 02270 - Erosion and Sediment Control.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. State of Ohio, Department of Transportation (ODOT), Construction and Material Specifications, January 1, 1997.  
1. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.

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- B. Certificates: Provide written certification from supplier of seed to state that the seed delivered to the project complies with the following:
1. Seed varieties and mixture comply with requirements of the specifications.
  2. Purity and germination rate comply with the requirements of the specifications.
- C. ~~Provide written certification from supplier of fertilizer to state that the items delivered to the project comply with the requirements of this section.~~

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in original, sealed containers. Seed in damaged packaging will not be accepted. Containers shall show:
1. Names and percentage of each seed variety.
  2. Year of production, percentage of purity, minimum germination rate, and date of packaging.
  3. Net weight.
- B. Deliver plant nutrients in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Store materials in a dry area, free from wetting and physical damage.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Seed
1. Varieties of grass involved in the work of this section shall be the following.
    - a. Permanent seeding:
      - 1) 40 percent Kentucky Bluegrass.
      - 2) 40 percent Creeping Red Fescue.
      - 3) 20 percent Annual Ryegrass.
    - b. Temporary seeding: 100% Annual Ryegrass
  2. Mixture shall be clean, guaranteed 95 percent pure, and have a minimum germination rate of 85 percent within 1 year of test.

- B. Soil Materials
  - 1. As specified in Section 02200.
- C. Plant Nutrients
  - 1. Fertilizer:
    - a. Fertilizer shall be VCOTE 34-0-14 (no substitution allowed).
- D. Water
  - 1. Potable, clean, and free of substances or matter which could inhibit vigorous growth of grass.
- E. Materials used for mulching shall be straw or hay. Mulch shall be reasonably free of weed seed and such foreign materials as may detract from their effectiveness as a mulch or injure desired plant growth.

### **PART 3 EXECUTION**

#### **3.1 FIELD CONDITIONS**

- A. Verify that the soil surface is ready to receive work of this section and that final dressing is within reasonably close conformity to lines, grades, and cross-sections as shown on the construction drawings.
- B. Prepare soil by tilling/cultivating to eliminate uneven areas and low spots. Maintain lines, levels, and contours. Make changes in grade gradual. Blend slopes into level areas.
- C. Remove debris, weeds, and undesirable plants and their roots.
- D. Repeat cultivation in areas where equipment used for hauling and spreading has compacted subsoil.

#### **3.2 APPLICATION**

- A. Application of Plant Nutrients:
  - 1. Apply fertilizer at the rate of 4 pounds per 1000 square feet.

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2. Mix thoroughly into upper 2 inches.
3. Lightly water to aid the distribution of fertilizer.

B. Seeding:

1. Apply permanent seed mixture at a minimum rate of 130 lbs per acre in accordance with ODOT Item 659.09. When applying seed with a broadcast spreader, ~~apply evenly in two intersecting directions.~~
2. Do not seed areas in excess of that which can be mulched on same day.
3. Permanent seeding as specified above shall be performed between March 15 and October 15.
  - a. All seeding performed between October 15 and March 15 shall be temporary seeding in accordance with ODOT Item 207. Areas seeded with the temporary seed mix shall be reseeded with the permanent seed mixture during the specified application period.
4. Immediately following seeding, apply mulch.
5. Mulch shall be spread in a 1 to 2 inch layer.
6. Apply water with a fine spray immediately after each area has been mulched. Wet soil to approximately 4 inches deep, at a rate of 120 gallons per 1,000 square feet.

- C. Coordinate seeding with Section 02270 - Erosion Control. Areas requiring additional measures after the application of seed shall be closely coordinated with this Section.

3.3 TEMPORARY SEEDING

- A. All areas of temporary seeding, ~~such as soil stockpiles~~ and denuded areas to remain undisturbed for more than 45 days, shall be seeded with Annual Ryegrass sown at the rate of 2 pounds per 1000 square feet and mulched.
- B. Mulch for temporary seeding shall be as described herein for permanent seeding.

### 3.4 FIELD QUALITY CONTROL

A. Notify FDF at least three working days prior to date of anticipated inspection.

1. To qualify for acceptance, ~~an area shall have a good clean stand of perennial grass.~~ Within three weeks after sowing grass seed, germination shall have occurred over 95 percent of the seeded area. If, after three weeks, more than 5 percent of the seeded area is comprised of non-germinating areas (areas greater than 3 square feet without visible germination of grasses), reseeding will be required in the non-germinating areas. Within three months, 95 percent of the seeded area shall be covered with mature perennial grasses. If, after three months, more than 5 percent of the seeded area is not covered by mature perennial grasses, the barren areas must be reseeded.

2. ~~Coverage shall be at least 95 percent of the area, and no bare spots shall exceed 3 square feet.~~

2. Areas that fail to meet requirements of the specifications shall be repaired or re-seeded as necessary to produce an acceptable stand of grass.

END OF SECTION

SECTION 02999  
MISCELLANEOUS AND SPECIALTY ITEMS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Installation of construction fence at the limit of work and other locations as indicated on the construction drawings.
- B. Fabrication and installation of caution signs.
- C. Installation of ring buoys.

**1.2 RELATED SECTIONS**

Not Used.

**1.3 REFERENCES**

- A. ODOT Construction and Material Specifications, Item 603.
- B. OSHA 29 CFR Part 1926

**1.4 DELIVERY STORAGE AND HANDLING**

- A. Construction fence, signs, and buoys shall be delivered to the site and protected from damage. Damaged items will be removed from the site and replaced at the subcontractor's expense.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.
- B. Twenty days prior to the start of work, submit for review and approval the following:
  - 1. Construction fence.
  - 2. Caution signs, drawing to scale including color notations.

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3. Buoys.

**PART 2 PRODUCTS**

**2.1 PRODUCTS INCLUDED**

- A. Caution signs, flat sheet aluminum, 0.063-inch thick, 12-inch minimum dimension in any one direction, yellow ~~reflective sheeting background, black lettering a minimum~~ of one inch in height, all capital letters, standard block lettering. Signs shall read as follows:

**CAUTION - DROWNING HAZARD, LIFE VEST REQUIRED WITHIN  
5 FEET OF WATER**

- B. Construction fence shall be yellow, high density polyethylene, 4-foot height, opening size approximately 4-inches by 1/2-half inch, minimum tensile strength of 2000 lbs/ft of width. Posts shall be steel "T" as indicated on the construction drawings. Rebar shall not be permitted.
- C. Buoys and line shall be U.S., Coast Guard approved, as required by OSHA in 1926.106.

**PART 3 EXECUTION**

**3.1 CONSTRUCTION FENCING**

- A. Install construction fence along the Limits of Work at the locations designated on the construction drawings. The construction fence shall be field located. The fence posts shall be driven. Secure and stretch the fence fabric to the posts in order to eliminate any sags horizontally and vertically. The bottom of the fence fabric shall be installed to a maximum of 2 inches above the finished grade.

### 3.2 CAUTION SIGNS

- A. Install caution signs on metal posts at 100 foot intervals (at a minimum per side) along the perimeter of the basins. Metal posts shall be driven and the sign securely bolted to the posts.

### 3.3 RING BUOYS

- A. Provide ring buoys and 90 feet of line at maximum 200 foot intervals around the perimeter of each sediment trap and sediment basin. Buoys and line shall be hung on metal or wood posts. The buoys shall be installed at approximately four feet above grade. Inspect each ring buoy for defects or damage. Repair or replace any damaged buoys.

### 3.4 GENERAL

- A. All signs, construction fence, posts, and buoys associated with the retention basin shall remain the property of FDF and shall remain on site.

END OF SECTION

## U.S DEPARTMENT OF ENERGY

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Subcontract No. FSC607

WASTE UNITS REMEDIATION PROJECT  
SOUTHERN WASTE UNITS  
TECHNICAL SPECIFICATIONS

Division 3

PARSONS

Prepared by:

*Franklin M. Parton Jr*8/27/97  
Date

Checked by:

*Kenneth H. Gaudin Jr*8/27/97  
Date

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SECTION 03001  
CONCRETE

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Concrete work for wheel wash pad, manhole bases, electrical switch gear pad extension, electrical service panel rack pad, duct banks, miscellaneous guard posts, fence post bases, and other miscellaneous concrete.
- B. Formwork and accessories.
- C. Reinforcement and accessories.
- D. Cast-in-place concrete and accessories.
- E. Finishing and curing.
- F. Sampling and testing of concrete work.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Non-impacted Material Earthwork.
- D. Section 02667 - Drinking Water Lines.
- E. Section 16118 - Underground Ductbanks.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

#### 1.4 REFERENCES

- A. American Concrete Institute (ACI):
1. ACI 301-96 Specifications for Structural Concrete for Buildings.
  2. ACI 305R-91 Hot Weather Concreting.
  3. ACI 306R-88 Cold Weather Concreting.
  4. ACI 318/318 R-95 Building Code Requirements for Structural Concrete (ACI 318-95) and Commentary (ACI 318R-95).
  5. ACI SP-66-94 ACI Detailing Manual.
- B. American Society for Testing and Materials (ASTM):
1. ASTM A185-94 Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
  2. ASTM A615- A615M-Rev A-96 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  3. ASTM C31/ C31M-96 Standard Practice for Making and Curing Concrete Test Specimens in the Field.
  4. ASTM C33-93 Concrete Aggregates.
  5. ASTM C39-96 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  6. ASTM C94-96 Ready Mixed Concrete.
  7. ASTM C109/ C109M-95 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
  8. ASTM C143- Rev. A-90 Standard Test Method for Slump of Hydraulic Cement Concrete.
  9. ASTM C150-96 Portland Cement.
  10. ASTM C157-93 Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete (AASHTO T160).
  11. ASTM C231- Rev B-91 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
  12. ASTM C260-95 Air-Entraining Admixtures for Concrete.
  13. ASTM C309-95 Liquid Membrane-Forming Compounds for Curing Concrete.
  14. ASTM C494-92 Chemical Admixtures for Concrete.

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- 15. ASTM C882-91 Standard Test for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
- 16. ASTM C920-95 Elastomeric Joint Sealants.

C. U. S. Department Of Commerce, Voluntary Products Standards (PS):

- 1. PS 1-83 Plywood.

1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011 and by Part 6 of the contract documents.
- B. Product Data: Concrete mix designs, including documentation of aggregate sources and most recent sieve analysis. Sieve analyses must not be older than 1 year.
- C. Concrete Supplier: Name and address of the transit-mix concrete supplier. Supply typical batch ticket and history per ASTM C94.
- D. Test Reports: Test reports for all tests required under Article 3.3.A.
- E. Placement Records: Records of time, dates, and locations of concrete placing operations upon completion of section work.
- F. Reinforcing Placement: Provide reinforcement fabrication drawings showing placement of all reinforcing, inserts, sleeves, etc.

1.6 TECHNICAL CLARIFICATION

- A. ACI 301: References are made to ACI 301 to abbreviate text of this section. Only those portions of ACI 301 referred to specifically in this section shall apply.
- B. Amend Subparagraph 1.3.1 of ACI 301 to change the following titles to read (wherever they occur in ACI 301):

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- C. Formwork shall be in accordance with Chapter 4 of ACI 301 unless specified otherwise in this section.
- D. Perform concrete reinforcing work in accordance with Chapter 5 of ACI 301, unless specified otherwise in this section.
- E. Perform cast-in-place concrete work in accordance with Chapters 7, 8, 10, 11, and 12 in ACI 301, unless specified otherwise in this section.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Tags: Reinforcing bar tags shall be made of durable material and marked in a legible manner with waterproof markings; not less than one tag per bundle, attached by wire. Identification tags shall show the grade, number of pieces, size, and mark or length of bars.

### PART 2 PRODUCTS

The listing of materials suppliers below in no way precludes the Subcontractor from proposing alternate suppliers of any of the materials to be furnished within the scope of this specification. This list of suppliers is intended to identify the type of materials and general quality of those materials that will be included in the Subcontractor's proposal. It is the Subcontractor's responsibility to propose materials that are best suited for this project in combined terms of quality and price.

#### 2.1 MATERIALS

- A. Oil/Water Separator:
  - 1. The Oil/Water Separator shall be a two interconnected chamber precast unit constructed of polymer concrete with a 220 gallon capacity. The unit shall be designed to entrap solids and float oils.

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2. Four-inch inlet and outlet pipe for connection to 4-inch diameter pipe running to and from the Separator.
  3. The unit shall be covered with cover plates constructed from 1/4-inch steel diamond plate. The cover plates shall be coated with two carbonic zinc coatings. Cover plates and support channels shall be designed to support slow speed pneumatic tire vehicle loadings of twenty tons gvt (gross vehicle weight) and five tons single wheel load. Cover plates shall be provided with a handle, ring, or other means of facilitating the removal of the plate to allow cleaning of the unit.
- 
- B. Plywood Forms: Not less than 5/8-inch thick, 5-ply Douglas fir plywood conforming to PS 1, and as manufactured by a member of the American Plywood Association; B-B Plyform, Class I, Exterior-APA, with plyform faces sanded and oiled.
  - C. Prefabricated Type Forms: Matched, tight fitting, stiffened to support weight of concrete.
  - D. Form Release Agent: Colorless mineral oil which will not stain concrete or impair natural bonding characteristics of subsequent coatings.
  - E. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars; plain finish.
  - F. Welded Steel, Wire Fabric: ASTM A185, plain type welded wire fabric.
  - G. Tie Wire: Minimum 16-gage annealed type wire.
  - H. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
  - I. Fabrication: Fabricate concrete reinforcing in accordance with ACI SP-66 and Chapter 7 and 12 of ACI 318.

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- J. Cement: Normal, Portland cement, conforming to requirements of ASTM C150, Type I.
- K. Admixtures:
  - 1. Air Entrainment: Conforming to ASTM C260.
  - 2. Water Reducing and Retarding: Conforming to requirements of ASTM C494.
- L. Aggregates:
  - 1. Normal Weight Concrete: Conforming to requirements of ASTM C33.
  - 2. Maximum aggregate size: 1 inch.

## 2.2 ACCESSORIES

- A. Chamfer Strips: Chamfered, wood strip type; 3/4-inch by 3/4-inch size.
- B. Nails, Spikes, and Anchorages: Sized as required and of sufficient strength and character to maintain formwork in place while placing concrete.
- C. Form Ties: Removable or snap-off type; designed to prevent form deflection; of adjustable length, cone type, with waterproofing washer; and free of defects that could leave holes larger than 1 inch in concrete surface.
- D. Curing Compound: Conforming to the requirements of ASTM C309, clear; must not impair natural bonding characteristics of subsequent coatings.
- E. Joint Sealer: Elastomeric joint sealant conforming to ASTM C920; Type S or Type M, Grade P, Class 25.
  - 1. Acceptable products and suppliers (or equal):
    - a. Sikadur 51 SL, by Sika Corp.
    - b. Sonolastic SL-1, by Sonneborn Building Products.
- F. Patching Grout: Premixed, nonshrink epoxy grout, capable of developing minimum compressive strength of 3,000 psi in 24 hours, conforming to ASTM C109. The grout must not shrink or expand more than 5 percent

when tested in accordance with ASTM C157 and achieve a minimum bond strength of 1,200 psi in 24 hours when tested in accordance with ASTM C882.

- G. Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F. Working temperature range, preformed corners, with heat-welded jointing.

## 2.3 CONCRETE

### A. Mix Proportions:

1. The following mix designs shall be used for cast-in-place concrete.

a. Slabs

Specified Strength (28 days)	4,000 psi
Total Air Content:	5 ± 1-1/2 percent
Specified Slump:	4 inches ± 1 inch
Maximum Aggregate Size:	1 inch
Maximum Water/Cement Ratio:	0.35 (per ACI 318, Section 5.4)

Water Reducing and retarding admixtures as required per ASTM C494.

b. Ductbank

Specified Strength (28 days)	2,500 psi
Specified Slump:	6 inches ± 1-1/2
Max. Aggregate Size	3/8 inch
Max. Water/Cement Ratio	0.80

c. Fence posts, guard posts, and other miscellaneous concrete

Specified Strength (28 days)	3,000 psi
Total Air Content:	5 ± 1-1/2 percent
Specified Slump:	3 inches ± 1-1/2
Maximum Aggregate Size:	1-1/2 inches
Maximum Water/Cement Ratio:	0.55

2. The work has been designed for concrete having a minimum compressive strength at 28 days as determined by ASTM C39. The water/cement ratio shall be determined by consideration of the specified strength, the water-reducing admixtures, the slump required for proper placement, air entraining requirements, the maximum allowable aggregate size and its specific gravity, the ~~fineness modulus of the fine aggregate and its~~ specific gravity, and the amount of water carried on the aggregates. The mix designs shall be proportioned in accordance with ACI 318, Section 5.3 or Section 5.4.
3. Provide all equipment necessary to determine and control the actual proportions of materials entering the batch. Slumps shall be recorded for each trial batch.

B. Water Content: In calculating the total water content in any mix, the amount of water carried on the aggregate shall be included. The water on the aggregate shall be determined periodically by test, and the amount of free water on the aggregate shall be subtracted from the water allowed in the mix. In all cases, the amount of water to be used shall be the minimum amount required to produce a plastic mixture of the specified strength and slump.

C. Mixing and Delivery: Mixing and delivery of concrete shall be scheduled so that all concrete placing operations can be completed within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first, after introduction of mixing water to cement and aggregates, in accordance with Section 11 of ASTM C94. When air temperature has fallen to or is expected to fall below 40 degrees F, the recommendations for cold weather concreting contained in ACI 306R shall be followed. When the air temperature exceeds 90 degrees F, the recommendations for hot weather concreting contained in ACI 305R shall be followed.

**PART 3 EXECUTION****3.1 FORMWORK PREPARATION**

- A. Erect formwork and bracing to achieve design requirements in accordance with requirements of Chapter 4 of ACI 301.
1. Provide bracing to ensure stability of formwork.
  2. Align joints and make watertight. Keep number of form joints to a minimum.
  3. Provide chamfer strips on external corners of permanently exposed edges.
  4. Shore or strengthen formwork subject to overstressing by construction loads.
- B. Application - Form Release Agent: Apply form release agent on formwork in accordance with manufacturer's instructions.
1. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
  2. Keep surfaces coated prior to placement of concrete.
- C. Form Cleaning: Clean and remove foreign matter within forms as erection proceeds.
1. Clean formed cavities of debris prior to placing concrete.
  2. Flush with water or vacuum to remove remaining foreign matter.
  3. Ensure that water and debris drain to exterior.
  4. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms.
- D. Tolerances: Construct formwork to maintain tolerances required by ACI 301, Section 4.3.
- E. Form Removal: Forms or bracing shall not be removed until concrete has gained sufficient strength to carry its own weight and imposed loads.
1. Loosen forms carefully.
  2. Do not wedge with pry bars, hammers, or tools against finished concrete surfaces.

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### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Place, support, and secure reinforcement against displacement. Do not deviate from required position.
- B. Maintain concrete cover around reinforcing according to the requirements of Chapter 5 of ACI 301, Chapter 7 of ACI 318, and as shown on construction drawings.
- C. Provide formed openings where required for work to be embedded in concrete.
- D. Coordinate work of other sections in forming and setting openings, slots, recesses, sleeves, bolts, anchors, and other inserts.
- E. Install concrete accessories straight, level, and plumb, or as called out on the construction drawings in accordance with manufacturer's instructions.
- F. Place concrete continuously between forms or other limits indicated on the construction drawings.
  - 1. Place concrete in accordance with Chapter 8 of ACI 301 and Chapter 5 of ACI 318.
  - 2. Ensure that reinforcement and forms are not disturbed during concrete placement.
- H. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

### 3.3 TESTING

- A. Testing: Field tests (take slumps, air, and cylinders) and laboratory tests shall be performed on specimens. Concrete testing shall be performed in accordance with Chapter 16 of ACI 301 for each 50 cubic yards, or fraction thereof, of each mix design placed in any 1 day.
  - 1. Slump Tests: ASTM C143. One sample for each strength test.
  - 2. Air Content Tests: ASTM C231. One sample for each strength test.

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3. Test Cylinders: ASTM C31. One set of three cylinders for above quantities.
4. Compressive Strength: ASTM C39. One specimen tested at 7 days and two specimens tested at 28 days.

#### 3.4 PROTECTION

- A. Provide concrete curing and protection in accordance with Chapter 12 of ACI 301.
  1. Apply slab curing compound, where used, in accordance with the approved manufacturer's recommendations.
- B. Provide finishes for formed concrete surfaces as defined in Chapter 10 of ACI 301.
- C. Provide finishes and tolerances for slabs in accordance with Chapter 11 of ACI 301.
  1. Provide troweled finish with Class A tolerance on all exposed slabs.

END OF SECTION

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Subcontract No. FSC607

WASTE UNITS REMEDIATION PROJECT  
SOUTHERN WASTE UNITS  
TECHNICAL SPECIFICATIONS

Division 13

PARSONS

Prepared by:

O.W. Carlson 8-25-97 Date

Checked by:

Sal Galt 8/25/97  
Date



*Oscar W. Carlson, Jr.*

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SECTION 13125  
MODULAR RADIOLOGICAL CONTROL FACILITY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Duplex System (One Required): A personnel radiological control facility composed of two nominal 14 feet by 60 feet interconnected modular units combining separate men's and women's locker rooms, each consisting of locker area, emergency showers, sinks, and a common break room. Interior ceiling height to be 8 feet 0 inches minimum. The duplex facility will consist of designed and shop fabricated ~~and fire-resistant~~ modular trailer units.
- B. Mechanical and electrical requirements. Electrical requirements herein are for modular radiological control facility only. Where these requirements conflict with those of other specification sections, the requirements of this section govern for the modular radiological control facility only.
- C. Fire and evacuation alarm system requirements.

1.2 RELATED SECTIONS

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02100 - Site Preparation.
- D. Section 02200 - Non Impacted Material Earthwork.
- E. Section 16050 - Basic Electrical Materials and Methods.
- F. Section 16170 - Grounding and Bonding.
- G. Section 16855 - Heating Cables.

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### 1.3 REFERENCE DRAWINGS

- A. SKA04502, Duplex Manufactured Trailer, Floor Plan (See Attachment A).
  - B. 44X-5500-E-00210, Radiological Control Unit Facilities, 2-Plex and 4-Plex Electrical Single Line and Grounding (See Attachment B).
- 
- C. See Section 01012 for the Schedule of Drawings.

### 1.4 REFERENCES

- A. Conform to the OBBC and local building code. Where Hamilton County code requirements vary from the OBBC, the Hamilton County code shall govern.
- B. Cooperate with regulatory agency or authority and provide data as requested.
- C. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
  - 2. NFPA 72-93 National Fire Alarm Code.
- D. Underwriter's Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directory - 96.
- E. American Society for Testing and Materials (ASTM):
  - 1. E84 Rev-A-97 Standard Test Method for Surface Burning Characteristics of Building Materials
- F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)

### 1.5 SYSTEM DESCRIPTION

- A. Design Requirements - Structural
  - 1. System and components to withstand dead loads, live loads, snow load, and wind load calculated in

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accordance with the Ohio Basic Building Code, OBBC.

Design constants shall be as follows:

- a. Ground Snow Load ( $P_g$ ): 25 psf
  - b. Snow Exposure Factor ( $C_e$ ): 0.7
  - c. Importance Factor ( $I$ ): 1.0
  - d. Effective Velocity Pressure ( $P_e$ ): 20 psf (80 mph basic wind speed, Exposure C)
  - e. Floor Live Load: 50 psf
2. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
  3. Assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
  4. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

B. Design Requirements - Mechanical

1. Thermal resistance of Wall System: R value of 11 minimum.
2. Thermal Resistance of Roof System: R value of 30 minimum.
3. Thermal Resistance of Floor System: R value of 19 minimum.
4. Heating & Cooling: Air source wall mount heat pumps, 48,000 Btu/hr. capacity per unit, one for each 14 feet by 60 feet module. Each heat pump to be equipped with supplemental electric resistance heaters, 15 kW @ 480 V, balanced across the 3 phases (5 kW each).
5. Ductwork: Design in accordance to the methods given by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Fabricate in accordance with methods given in the Sheet Metal and Air Conditioning Contractors (SMACNA) Manuals.
6. Plumbing: Design cold potable water, hot water, and sanitary systems in accordance with OBBC. Sanitary (grey) water from the emergency showers and sinks shall be collected in hold tanks located beneath the trailer facility. The tanks shall be configured to provide a total storage capacity of 1,000 gallons. Prior to

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placing the tanks beneath the trailer facility, the site shall be leveled and pressure-treated plywood shall be placed on the ground with electric heat pads provided beneath the hold tanks. The tanks shall be interconnected with a discharge pipe located so as to protrude through the trailer skirting. Tanks and pipe shall be insulated using a minimum R-13 insulating material.

7. ~~Fire Protection: Minimum of one (1) ten (10) lb. size~~  
"ABC" type fire extinguisher at each exterior door.

C. Design Requirements - Electrical

1. Electrical work shall be designed and installed in accordance with NFPA 70 and drawing 44X-5500-E-00210 (Attachment B).
2. Electrical equipment shall be listed for the purpose specified and indicated according to Underwriter's Laboratories (UL) Electrical Construction Materials Directory.
3. The HVAC and water heaters are to be 480 V, 3-Phase. The lights and the remaining electrical requirements are to be served from the 208/120 V, 3-Phase, 4-Wire panel.
4. A separate 208/120 V, 3-Phase, 60 Hz panel shall be furnished and mounted outside each modular section in a NEMA 3R enclosure.
5. The panel shall have a 100 amp main breaker minimum.
6. The panels shall be mounted on the same end of the trailer as the HVAC unit.
7. Wire: Use copper insulated wire in electrical circuits. Minimum wire size shall be 12 gauge unless noted otherwise.
8. Conduit: Electrical wiring to be installed in EMT conduit. Minimum size to be 1/2 inch conduit. A separate green grounding wire shall be installed. No conduit runs shall be used for equipment grounding.
9. Receptacle circuits are to be rated at 20 amps. Receptacle and light switches shall be labeled identifying the appropriate circuit breaker and shall have fixed labels to identify serviced circuits.

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- Provide dedicated circuits for PCMs, fire and evacuation alarm systems, and storage tank heat pads.
10. 480 V, 3-Phase equipment shall be wired to a fused safety switch located on the same end of the trailer as the panel. Appropriate size fuses shall be installed.
  11. Exit Signs: Install low energy consumption solid state, LED, exit signs with battery back-up at exits.
  12. Emergency Lights: Provide emergency egress lighting with battery back-up to illuminate the paths to exits.
  13. A lighting level of 60 footcandles shall be provided at a height of three feet above the floor.
  14. Lighting shall be controlled by switches, not breakers.
  15. General interior lighting shall be 4 feet 0 inches double tube surface fluorescent (T8) fixtures each with diffusers, electronic ballast and lights. Other interior and exterior lighting shall be incandescent.
  16. Provide one (1) 50 watt high pressure sodium light fixture with photo cell and light, outside of each exterior door. Teron Catalog No. CA50 or equal.
  17. Electrical outlets at porter's closet and external receptacles within 6 feet of sink serving counter top surfaces shall be GFCI type.
  18. Telephone: Each modular complex shall be equipped with a minimum of four (4) telephone outlets. Telephone raceways are to be 3/4 inch EMT conduits. Run conduit from each outlet to central junction box at the front of the trailer. Locate outlets per attached engineering sketches.
  19. Telephone/communication junction boxes are to be located on the same end of the trailer sections which comprise the complex and shall be surface mounted. Exterior junction boxes shall be rated NEMA 3R minimum and shall be mounted with taps to accommodate two (2) inch conduits.
  20. Telephone/communication outlets shall be provided with a blank ivory cover plate for single outlet box (wire and receptacle to be supplied by telephone company, minimum four (4) telephone outlets per modular complex).
  21. Electrical outlet devices shall be ivory with ivory cover plates.

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22. Grounding: Trailer frame and metallic sheathing shall be grounded to breaker panel.
23. High water level alarm for water hold tanks. The alarm will be equipped with a warning light and audible alarm.

D. Design Requirements - Fire and Evacuation Alarm

1. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to the central fire alarm equipment.
2. Install fire and evacuation alarm equipment specified herein and indicated on sketch SKA04502. Honeywell, FDF's alarm systems Subcontractor, will make final terminations and perform acceptance testing of the new panel.

1.6 SUBMITTALS

- A. Provide submittals as required by Section 01011 and Part 6 of the Contract Documents.
- B. Submit complete set of shop drawings within two (2) weeks of Contract award. Submit twelve (12) copies and one (1) reproducible.
- C. Indicate recommended location of structural supports.
- D. Indicate the number and location of intermediate support columns.
- E. Indicate wall and roof system dimensions and general construction details.
- F. Indicate number and location of downspouts.
- G. Indicate tie-down requirements for wind loads.
- H. Product Data: Provide data on mechanical components.
- I. Manufacturer's Installation Instructions: Indicate preparation requirements and assembly sequence.

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## 1.7 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with a minimum ten (10) years experience.

## 1.8 WARRANTY

- A. Provide five-year warranty.
- B. Warranty: Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading.
- C. Guarantee that mating modular sections are capable of weather-tight field fit-up.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS - BUILDING SYSTEM

- A. Manufactured Structures Corporation, System OBBC Model 1464.
- B. Other acceptable manufacturers offering equivalent systems.

### 2.2 MATERIALS - MODULAR UNITS

- A. Materials - Architectural/Structural
  - 1. Framing: Steel I beam with cross member outrigger.
  - 2. Under-floor Bottom Plate: Manufacturer's standard.
  - 3. Floor Underlayment: 3/4-inch plywood, pressure treated. ~~Fire-resistant treated for all wood products.~~
  - 4. Walls: Stud framing with gypsum board interior.
  - 5. Insulation: Batt glass fiber type, faced with reinforced foil, ~~friction fit.~~
  - 6. Roofing: Galvanized steel, 30 ga.
  - 7. Ceiling: 1/2-inch vinyl coated gypsum, Group 2 vinyl weight. ~~(Class 1 flame spread with rosettes)~~

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8. Exterior Siding: Manufacturer's standard corrugated aluminum.
9. Skirting: Manufacturer's standard corrugated aluminum.
10. Interior Wall Covering: 1/2-inch vinyl coated gypsum, Group 2 vinyl weight. ~~Exposed surface shall have been tested by a recognized testing lab, as having a flame spread rating not to exceed 25 and single developed rating not in excess of 50 per ASTM E 84.~~
11. Flooring: Commercial grade sheet vinyl.
12. Doors, Exterior: Hollow Metal type, 36 inches by 80 inches, 16 gauge, insulated, glass side light, door closer, shop primed and finish painted. Keyed lock-set to accept "Best" core.
13. Doors, Interior: ~~Hollow Metal type~~ Wood solid core, 36 inches by 80 inches, 16 gauge, 24-inch square door grill, passage-set.
14. Windows: Manufacturer's standard horizontal slider with insect screen where required by building code. Translucent glass in locker, shower or sink areas.
15. Gutters & Downspouts: Fabricate of same material and finish as siding metal.

B. Materials - HVAC

1. Heat Pump: 48,000 Btuh cooling, 15 kW heating, wall mounted self-contained air cooled, with hermetic reciprocating compressor, crankcase heater, and pressure service ports on refrigerant piping to evaporator and condenser. Adjustable outside air intake and return air through wall grille with two inch cleanable media filter. Thermostat to be programmable located five feet above floor in clean area.
2. Ductwork: Galvanized steel, fabricated and installed per SMACNA. Insulated with two inch fiberglass having vapor barrier. Flexible joint at HVAC unit outlet. Ceiling diffusers to be white enamel aluminum with adjustable dampers.
3. Exhaust Fans: 300 CFM ceiling mount with roof cap in each shower room and break room. Fans in shower areas, aluminum or plastic for corrosion resistance. Fans interlocked with light switch.

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C. Materials - Plumbing

1. Showers: Heavy gauge steel with baked enamel finish, 32-inch square nominal, center drain with tempered glass door in aluminum frame. The shower must be drained through a filtration system with a minimum of a 5 micron final filter to remove asbestos.
2. Water Heater: Electric 120 gallon storage type, 480 V-3 phase, 162 gallon per hour recovery, ASME tank 300 psig hydrostatic tested, glass lined tank with anode rods and ASME pressure-temperature relief valves.
3. Shower Supply: Fixed spray shower head with 3 gpm maximum flow, single lever thermostatic mixing valve.
4. Faucets: Centerset with gooseneck spout and aerator, 4-inch wrist action handles.
5. Waste and Vent Piping: ABS DWV with solvent welded joints. Each unit to have waste lines manifolded to one outlet.
6. Water Piping: Type "L" copper with soldered sweat fittings manifolded to one inlet. Solder shall contain no lead.
7. Fixture Traps and Drains: Chromium plated brass traps with screen inlet drains in lavatories. Shower drains, PVC or ABS with screen inlet. Provide adapters for dissimilar materials where required.
8. Hold Tanks: Polyethylene holding tanks interconnected so as to provide a total storage capacity of 1,000 gallons. Interconnecting and discharge pipe to be 3-inch PVC. Discharge pipe will protrude through trailer skirting. Insulate tanks and pipe with a minimum R-13 insulating material. Level tank base under trailers and install pressure-treated plywood and heat pads prior to installing tanks. Install level alarm with audible alarm and warning light.

D. Materials - Fire and Evacuation Alarm

1. Fire Alarm Circuit Conductors: 18/2 wire; Initiating device insulation color coded red and yellow; Signal device circuit insulation color coded brown and yellow.
2. Wiring (Safety Devices): Fire Alarm Horns/Strobes - 18/2 yellow/brown wire; All Input Zones - 18/2 yellow/red wire.

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3. Smoke Detectors: Ionization type; Honeywell TC805C or approved equal.
4. Heat Detectors: Combination rate-of-rise and fixed temperature; Honeywell T4057A (135 degrees F setting and 15 degrees F per minute rate-of-rise) or approved equal.
5. Manual Pull Stations: Honeywell S464A or approved equal.
6. Horn with Strobe: Flush/Surface mounted, audio/visual type with strobe; Honeywell SC716B1001 or approved equal.
7. End of Line Resistors: 1.9 K ohms.
8. Motorola Monitor II Pager with charger amplifier: Motorola's HOYUMC3112, HOYUMC3122, and NLN3039A or approved equal.
9. Fire Alarm Panel: Honeywell FS 90 or approved equal.
10. Lightning Protectors shall be used on fire alarm branch circuits or evacuation branch circuits when entering or leaving facility.

E. Materials - Accessories

1. Lockers: Enamel finish sheet steel, double tier type, 12 inches wide by 15 inches deep by 72 inches high.
2. Fire Extinguisher: 10 lb. capacity, ABC type, one mounted at each exit door.
3. Tables (2 required.): Metal frame with metal legs, 30 inches by 72 inches, laminated plastic, "Formica" or hardboard top.
4. Chairs (16 required.): Metal frame, stackable type.
5. Towel Bins: Sheet metal with enamel finish, 3 cubic feet minimum capacity.
6. Hand/Hair Dryers: Surface mount, cast iron with porcelain enameled finish, 115V, 20 amp. McMaster-Carr #2876k71 or equal.
7. Anti-C Storage Cabinets: Minimum 22 gauge metal with enamel finish, 36 inches wide by 18 inches deep by 72 inches high, 5 or 6 shelves.
8. Locker Room Benches: Lengths as indicated on Drawings. Benches anchored to floor.
9. Counter Tops: Laminated plastic "Formica" top finish.

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10. Soap Dispenser (One per sink): McMaster-Carr #2379K32 or equal.
11. Paper Towel Dispensers (One per each sink grouping): 22 gauge steel minimum.
12. Coat & Hat Wall Racks (Two per break room): Two shelf type, aluminum tubing construction, 72 inches long, McMaster-Carr #4711T31 or equal.
13. Coat & Hat Wall Hooks (Four units per monitoring room): Horizontal type, chrome plated steel, with 6 each double hooks per 36 inches long unit.
14. Mirrors (One per sink): 1/4-inch plate glass, stainless steel frame.
15. PCMs: Furnished by FDF.
16. Friskers: Furnished by FDF.
17. Card Readers: Furnished by FDF.
18. Hand & Foot Monitors: Furnished by FDF.
19. Waste Drums: Furnished by FDF.
20. Stairs with hand railings are to be provided at entrances/exits from the trailers. The landings shall be level and at the same elevation as the doorways. Steps are to be a minimum 44 inches long with a minimum tread depth of 11 inches. The stair landings and steps shall have permanent, non-skid walking surfaces and will be securely arranged to resist movement.

### 2.3 FINISHES

- A. Framing Members: Clean, prepare, and coat with black asphalt undercoating, 3 mil minimum thickness.
- B. Exterior Surfaces of Wall Components and Accessories: Precoated enamel on aluminum, color as selected from manufacturer's standard range.
- C. Vinyl Sheet Flooring: Color and pattern as selected from flooring manufacturer's standard range.

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## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install the modular radiological control facility trailer to be ready for use when first needed to avoid delays in the work.
- B. Install the modular radiological control facility trailer at the designated location indicated on the plans. Set and level the trailer on concrete block piers in accordance with the trailer manufacturer's requirements. Anchor the trailer to prevent rollover, slipping, etc. during high winds. Set and level stairs and landings to minimize tripping hazards. Provide locking entrances to prevent unauthorized entry.
- C. Equipment connections and other necessary work within new Data Gathering Panel (DGP) shall be coordinated with FDF's fire alarm service company (Honeywell) at the direction of FDF. Subcontractor shall arrange and pay for the services of the fire alarm service company for performing necessary DGP work.
- D. Use 18 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in EMT conduit.
- E. Check that fire alarm detection end-of-lines device are with last device or in a separate box adjacent to last device in circuit.
- F. Connect new DGP to four pairs from the new phone service.

### 3.2 FIELD QUALITY CONTROL

- A. Test fire and evacuation alarm system in accordance with NFPA 72H and local fire department requirements. Tests to be witnessed by FDF QA and FDF Fire Protection. Demonstrate normal and abnormal modes of operation, and required responses to each.

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### 3.3 UTILITIES/SERVICING

- A. Install temporary utility services or make connections to existing services provided by FDF.
- B. Grey water hold tanks shall be periodically emptied (when indicated by the high water level alarm) and will be coordinated with FDF on the disposition of the water.

### 3.4 TERMINATION/RELEASE

- A. At completion of site preparation activities, restore trailer and contents to prework conditions. Housekeeping and repairs/replacements will be done to the satisfaction of FDF. When authorized by FDF, release the modular radiological control facility to FDF, including office equipment and interior components.

END OF SECTION

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ATTACHMENT A

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SKETCH SKA04502

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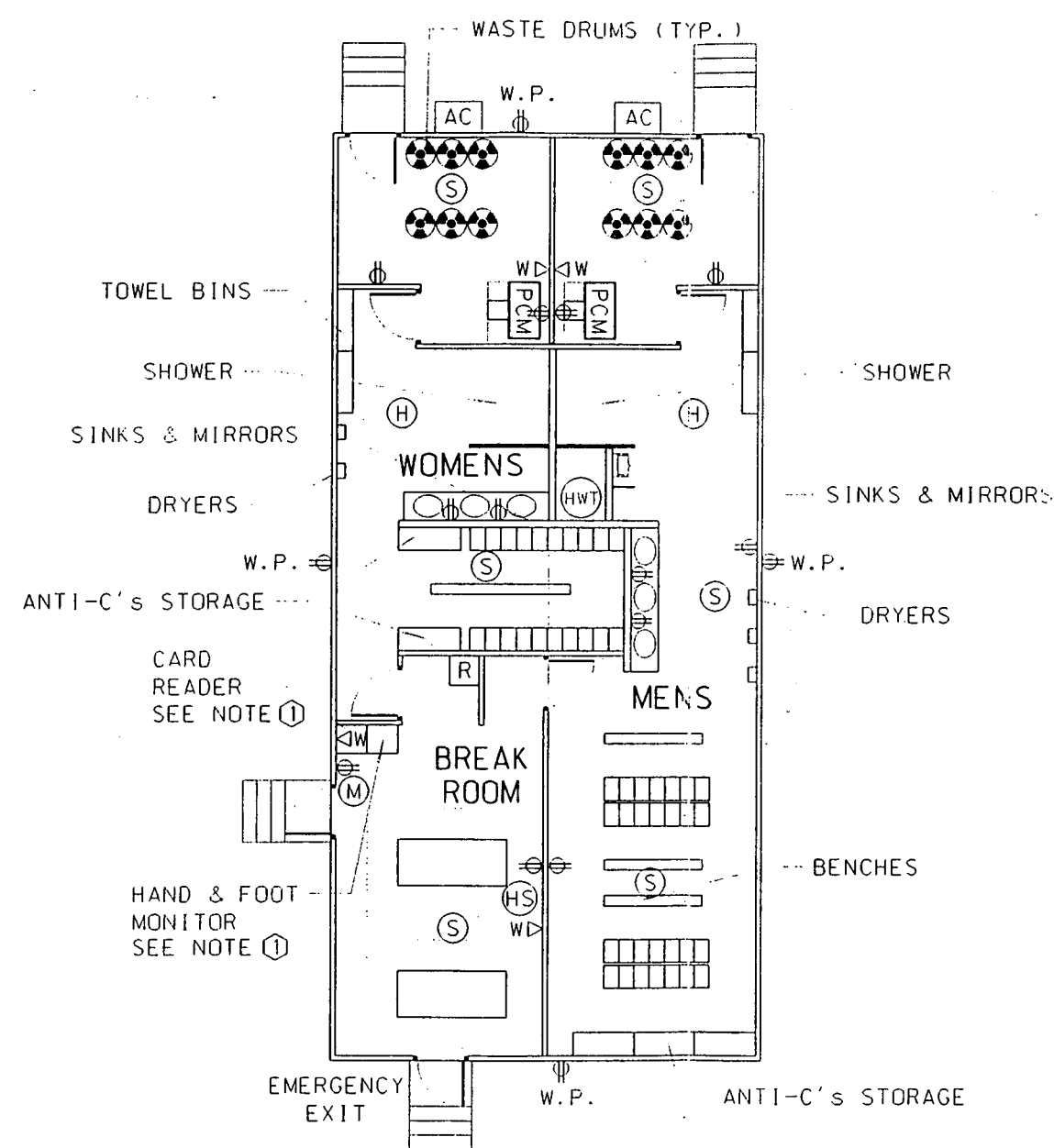
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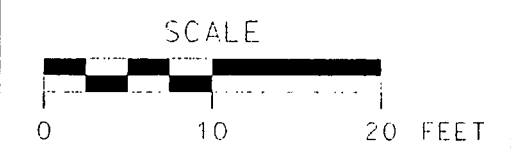
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# RADIOLOGICAL CONTROL POINT FACILITY



## DUPLEX MANUFACTURED TRAILER FLOOR PLAN

- NOTES
- CARD READER AND HAND & FOOT MONITOR (FDF PROVIDED)
- LEGENDS
- WASTE DRUMS (FDF PROVIDED)
  - LOCKERS: DOUBLE 12"Wx18"Dx72"H
  - PERSONNEL CONTAMINATION MONITOR (FDF PROVIDED)
  - HOT WATER TANK
  - PHONE LOCATIONS (4 REQ'D.)
  - EXTERIOR WEATHER PROOF RECEPTICAL LOCATIONS (4 REQ'D.)
  - DUPLEX RECEPTICAL LOCATIONS (12 REQ'D.)
  - SMOKE DETECTOR
  - HEAT DETECTOR
  - MANUAL PULL STATION
  - HORN STROBE
  - RAPID RECEIVER FOR EVACUATION SYSTEM



<b>UNITED STATES</b> <b>DEPARTMENT OF ENERGY</b> <b>FERNALD ENVIRONMENTAL MANAGEMENT PROJECT</b>			
THIS DRAWING PREPARED BY <b>PARSONS</b> THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO			
PROJECT NAME <b>WASTE UNITS REMEDIATION</b> <b>SOUTHERN WASTE UNITS - SITE PREPARATION PACKAGE</b>			
DRAWING TITLE <b>ARCHITECTURAL</b> <b>PLAN</b> <b>RADIOLOGICAL CONTROL POINT FACILITY</b>			
DRAWN BY D. TOPE	DATE 01/14/97	CHECKED BY W. MOORE	DATE 01/14/97
PLANT/DOC. NO. 1000	FLOOR FLOOR	SCALE SCALE	CLASS CLASS
SUBMITTED FOR APPROVAL		FERNALD CPU APPROVAL	
PREPARED UNDER PARSONS PROJECT ORDER NUMBER SCEP/P0-165	PROJECT NO. 00-90701	DRAWING NO. SKA04502	SHEET NO. 0

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ATTACHMENT B  
DRAWING 44X-5500-E-00210

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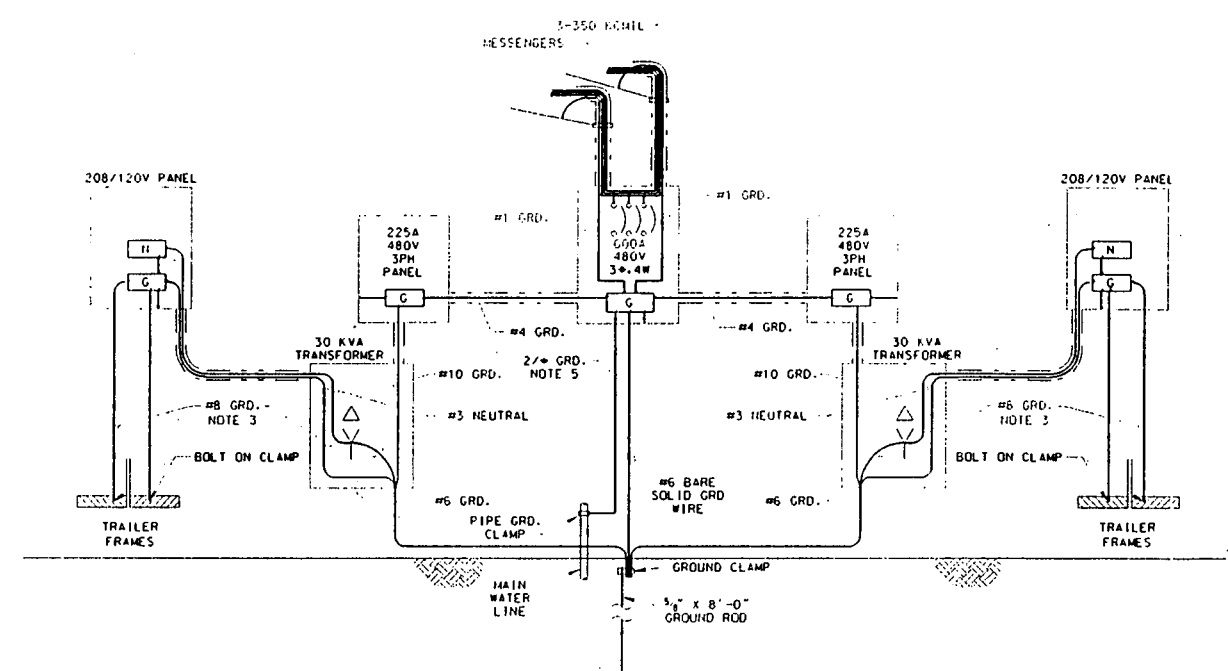
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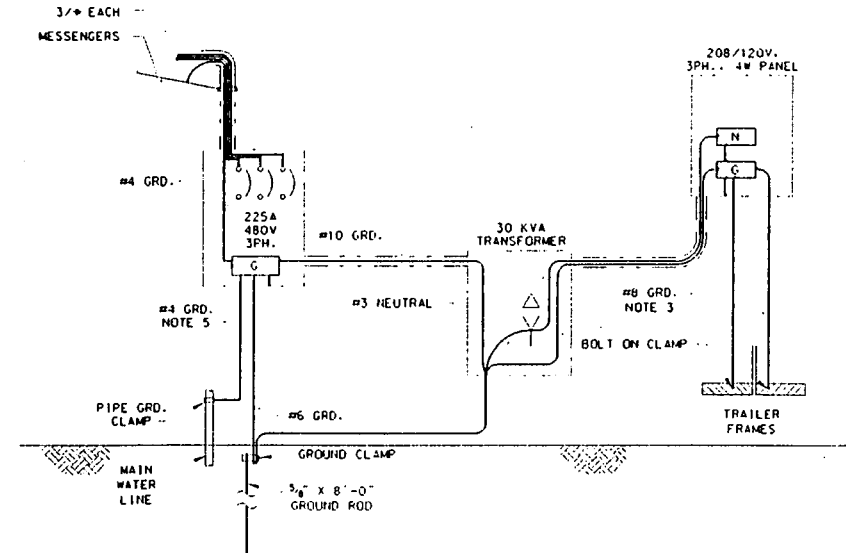
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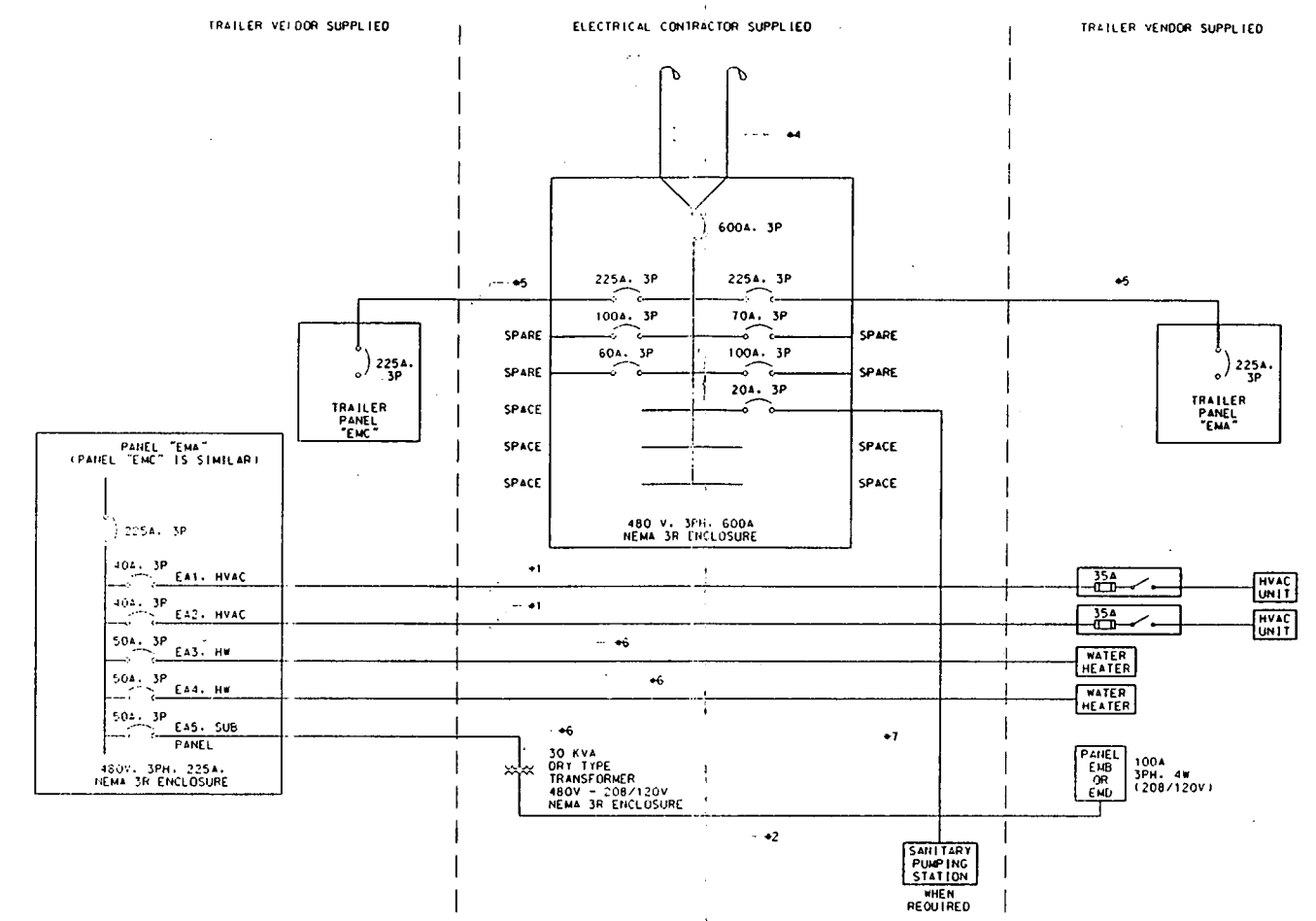
4-PLEX TRAILER GROUNDING



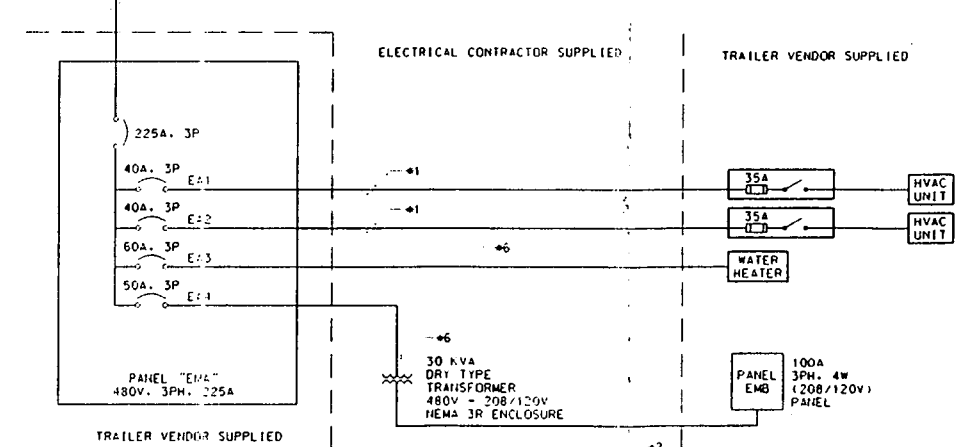
2-PLEX TRAILER GROUNDING



4-PLEX ELECTRICAL POWER DISTRIBUTION



2-PLEX ELECTRICAL POWER DISTRIBUTION



- NOTES
1. ALL WIRING TO BE COPPER WITH THWN INSULATION UNLESS NOTED.
  2. ALL GROUND WIRE IS TO BE COPPER.
  3. TRAILER VENDOR TO INSTALL
  4. USE SEALTIGHT CONDUIT WHERE REQUIRED
  5. REQUIRED WHEN WATER LINE IS METAL
- \*1 = 3-#8 AND 1-#10 GRD. 3/4" C  
\*2 = 4-#3 AND 1-#8 GRD. 1 1/2" C  
\*3 = 3-#4 AND 1-#8 GRD. 1 1/2" C  
\*4 = 2-3" CONDUITS EACH WITH 3-350 KCMIL AND 1-#10 GRD  
\*5 = 3-3/4" AND 1-#4 GRD. 2" C  
\*6 = 3-#6 AND 1-#10 GRD. 3/4" C  
\*7 = 3-#12 AND 1-#12 GRD. 3/4" C

REVISIONS				REVISIONS				REVISIONS			
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SECTION 13126  
MODULAR FIELD OFFICE FACILITY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Duplex System (One Required): A field office facility composed of ~~a single modular unit~~ two nominal 14 feet x 76 feet interconnected modular units. The facility will shall meet the requirements of an ODOT Type C field office trailer with ~~a minimum of 1000 sq. ft. of floor space will be partitioned off (with lockable door) for use by FDF Construction Manager. An additional 400 sq. ft. of open work space will be provided for use by FDF Construction personnel.~~ The single duplex facility will consist of designed and shop fabricated, and fire resistant modular trailer units.
- B. Mechanical and electrical requirements. Electrical requirements herein are for modular field office facility only. Where these requirements conflict with those of other specification sections the requirements of this section govern for the modular field office facility only.
- C. Subcontractor installed fire and evacuation alarm system requirements.

1.2 RELATED SECTIONS

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02100 - Site Preparation.
- D. Section 02200 - Non Impacted Material Earthwork.
- E. Section 13125 - Modular Radiological Control Facility.
- F. Section 16050 - Basic Electrical Materials and Methods.
- G. Section 16170 - Grounding and Bonding.

### 1.3 REFERENCE DRAWINGS

- A. SKA04503, Field Office Facility, Fire and Evacuation Alarm System Plan (See Attachment A).
- B. See Section 01012 for the Schedule of Drawings.

### 1.4 REFERENCES

- A. Conform to the OBBC and local building code. Where Hamilton County code requirements vary from the OBBC, the Hamilton County code shall govern.
- B. Comply with applicable requirements of NFPA Code 241, "Building Construction and Demolition Operations", the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".
- C. Comply with applicable requirements of NEMA and UL standards and governing regulations.
- D. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
  - 2. NFPA 72-93 National Fire Alarm Code.
- E. Underwriter's Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directory - 96.

### 1.5 SYSTEM DESCRIPTION

- A. Design Requirements - Structural
  - 1. Comply with the requirements of the Ohio Basic Building Code governing the construction, installation, and maintenance of temporary modular field office facilities.
- B. Design Requirements - Mechanical
  - 1. The facility shall have provisions for maintaining room temperature between 68 degrees and 80 degrees F.
  - 2. The facility shall have restrooms with fixtures as shown on Attachment A. Provide electric hot water heaters and hot and cold water plumbing systems.

Sanitary water shall be collected in hold tanks located beneath the facility. The tanks shall consist of two 250 gallon interconnected tanks with discharge pipe protruding through the trailer skirting. Provide electric heat pads under the tanks and insulation on the tanks and piping for freeze protection.

3. Fire Protection: Minimum of one (1) ten (10) lb. size "ABC" type fire extinguisher at each exterior door.

C. Design Requirements - Electrical

1. Electrical work shall be designed and installed in accordance with NFPA 70 and similar to drawing 44X-5500-E-00210 (Attachment B), Section 13125.
2. Electrical equipment shall be listed for the purpose specified and indicated according to the UL Electrical Construction Materials Directory.
3. The HVAC shall be 480 V, 3-Phase. The lights and the remaining electrical requirements are to be served from the 208/120 V 3-Phase 4-Wire panel.
4. A separate 208/120 V panel shall be furnished and mounted outside in a NEMA 3R enclosure.
5. The panel shall have a 100 amp main breaker minimum.
6. Exit Signs: Provide visible exit signs at exits.
7. Telephone: Install telephones in the field office facility. Separate telephone service shall be provided for the FDF construction personnel and for a separate facsimile line. Post a list of operational and emergency telephone numbers.
8. Grounding: Trailer frame, metallic sheathing, and other nonelectrical metal parts, as well as electrical parts shall be grounded through connection to a grounding bus in the modular field office facility distribution panel.

D. Design Requirements - Fire and Evacuation Alarm

Subcontractor installed fire and evacuation alarm system meeting the following design requirements:

1. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connection to the central fire alarm equipment.
2. Install fire and evacuation alarm equipment specified herein and indicated on sketch SKA04503. Honeywell, FDF's alarm systems Subcontractor, will make final terminations and perform acceptance testing of the new panel.

## 1.6 SUBMITTALS

- A. Indicate recommended location of structural supports.
- B. Indicate tie-down requirements for wind loads.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with a minimum ten (10) years experience.

## 1.8 WARRANTY

- A. Provide five-year warranty.
- B. Warranty: Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading.

## PART 2 PRODUCTS

### 2.1 MATERIALS - MODULAR UNIT

- A. Materials - Architectural
  - 1. Fire Extinguisher: 10 lb. capacity, ABC type.
  - 2. Equip each office and cubicle with:
    - (1) 1 - Telephone (on separate line)
    - (2) 1 - Desk and Chair Set
    - (3) 1 - 30 inch by 72 inch Work Table
    - (4) 1 - 4-Drawer, Legal Size, Lockable Metal Filing Cabinet.
  - 3. The conference room space shall be provided with:
    - (1) 1 - Telephone
    - (2) 6' x 8' Wall Board
    - (3) 1 - 3' x 8' (minimum) conference table with 8 chairs
  - 4. One cubicle shall be provided with:
    - (1) 2 - Plan Racks
    - (2) 1 - Plain Paper Facsimile Machine (on separate line)

(3) 1 - Copier with Automatic Paper Feed Capable of Making Copies up to 11 inches by 17 inches in size

5. Provide Base Radio and 4 Hand-held units.

6. Stairs with hand railings are to be provided at all entrances/exits from the trailer. The landings shall be level and at the same elevation as the doorways. Steps are to be a minimum 44 inches long with a minimum tread depth of 11 inches. The stair landings and steps shall have permanent, non-skid walking surfaces and will be securely arranged to resist movement.

B. Materials - Fire and Evacuation Alarm

1. Fire Alarm Circuit Conductors: 18/2 wire; Initiating device insulation color coded red and yellow; Signal device circuit insulation color coded brown and yellow.
2. Wiring (Safety Devices): Fire Alarm Horns/Strobes - 18/2 yellow/brown wire; All Input Zones - 18/2 yellow/red wire.
3. Smoke Detectors: Ionization type; Honeywell TC805C or approved equal.
4. Heat Detectors: Combination rate-of-rise and fixed temperature; Honeywell T4057A (135 degrees F setting and 15 degrees F per minute rate-of-rise) or approved equal.
5. Manual Pull Stations: Honeywell S464A or approved equal.
6. Horn with Strobe: Flush/Surface mounted, audio/visual type with strobe; Honeywell SC716B1001 or approved equal.
7. End of Line Resistors: 1.9 K ohms.
8. Motorola Monitor II Pager with charger amplifier: Motorola's HOYUMC3112, HOYUMC3122, and NLN3039A or approved equal.
9. Fire Alarm Panel: Honeywell FS 90 or approved equal.
10. Lightning Protectors shall be used on fire alarm branch circuits or evacuation branch circuits when entering or leaving facility.



## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install the modular field office trailer to be ready for use when first needed to avoid delays in the work.
- B. Install the modular field office trailer at the designated location indicated on the plans. Set and level the trailer on concrete block piers in accordance with the trailer manufacturer's requirements. Anchor the trailer to prevent rollover, slipping, etc. during high winds. Set and level stairs and landings to minimize tripping hazards. Provide locking entrances to prevent unauthorized entry.
- C. Equipment connections and other necessary work within the new Data Gathering Panel (DGP) shall be coordinated with FDF's fire alarm service company (Honeywell) at the direction of FDF. Arrange and pay for the services of the fire alarm service company for performing necessary DGP work.
- D. Use 18 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in EMT conduit.
- E. Check that fire alarm detection and end-of-lines device are with last device or in a separate box adjacent to last device in circuit.
- F. Connect new DGP to four pairs from the new phone service.

### **3.2 FIELD QUALITY CONTROL**

- A. Test fire and evacuation alarm system in accordance with NFPA 72H and local fire department requirements. Tests to be witnessed by FDF QA and FDF Fire Protection. Demonstrate normal and abnormal modes of operation and required responses to each.

### **3.3 UTILITIES**

- A. Install temporary utility services or make connections to existing services provided by FDF.

### 3.4 TERMINATION/RELEASE

- A. At completion of site preparation activities, restore trailer and contents to prework conditions. Housekeeping and repairs/replacements will be done to the satisfaction of FDF. When authorized by FDF, release the modular field office facility to FDF, including office equipment and interior components.

END OF SECTION

OU\DATA\OU-2\PO-165\WBS11236\SWU\SITE\13126

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**ATTACHMENT A****SKETCH SKA04503**

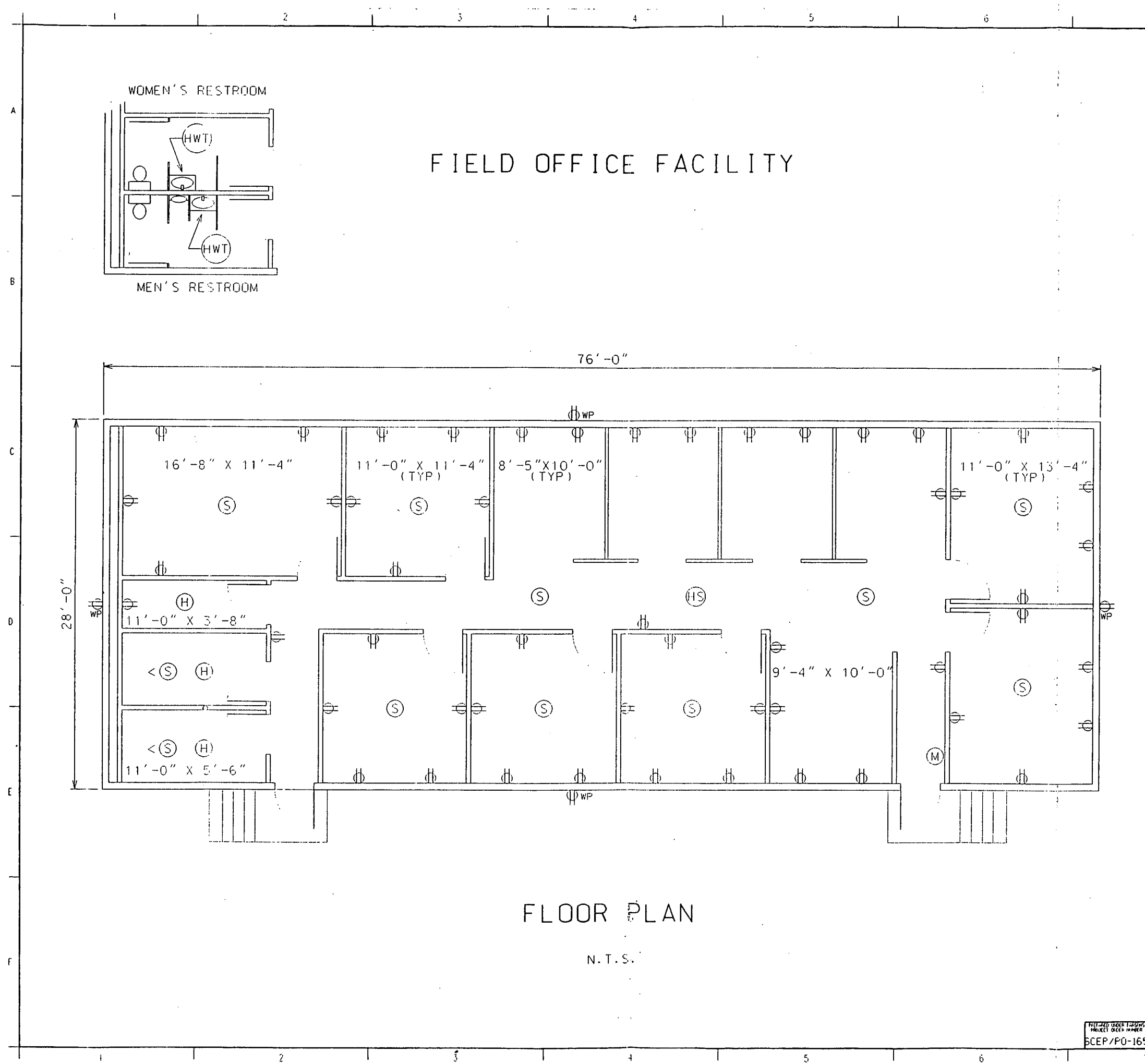
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LEGEND

- (S) SMOKE DETECTOR
- (H) HEAT DETECTOR
- (M) MANUAL PULL STATION
- (HS) HORN STROBE
- <(S) STROBE UNIT
- (DP) DUPLEX RECEPTICAL LOCATIONS
- (WP) EXTERIOR WEATHER PROOF RECEPTICAL, GFCI TYPE
- (HWT) HOT WATER HEATER MOUNTED BENEATH SINK

INCORPORATED FOR DCN* 20401:002: MODIFIED TRAILER LAYOUT			
CERTIFIED FOR CONSTRUCTION			
ISSUE OR REVISION PURPOSE - (DESCRIPTION)		DATE	BY
UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT		THIS DRAWING PREPARED BY <b>PARSONS</b> THE RALPH M. PARSONS CO. - PARSONS INVA, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO	
PROJECT NAME WASTE UNITS REMEDIATION SOUTHERN WASTE UNITS - SITE PREPARATION PACKAGE			
DRAWING TITLE ARCHITECTURAL PLAN FIELD OFFICE FACILITY			
DRAWN BY R. PROSA	DATE 01/30/97	DESIGNED BY W. MOORE	DATE 01/30/97
PERMITTED TO FLOOR	SCALE N.T.S.	CLASS CLASS	
SUBMITTED FOR APPROVAL		FERNALD CDO APPROVAL	
DATE 00-90701		DATE SKA04503	

## U.S DEPARTMENT OF ENERGY

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Subcontract No. FSC607

WASTE UNITS REMEDIATION PROJECTSOUTHERN WASTE UNITSTECHNICAL SPECIFICATIONS

Division 15

PARSONS

Prepared by:

Oscar W. Carlson5-28-97

Date

Checked by:

Sal Ahl5/28/97

Date

Oscar W. Carlson, Jr.  
5-28-97Date: 05/30/97  
Rev.: 0 RE: WM

15000

WBS No: 1.1.1.1.2.3.6  
SCEP/165/SWU/SITE

000200

SECTION 15060  
PIPE, FITTINGS, VALVES, AND ACCESSORIES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Pipe.
- B. Fabricated piping assemblies.
- C. Fittings.
- D. Valves.
- E. Specialty items.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.
- C. Section 02667 - Drinking Water Lines.
- D. Section 02668 - Transfer Line.
- E. Section 15090 - Piping Supports and Anchors.
- F. Section 15250 - Insulation.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES, CODES, AND STANDARDS**

- A. American Society of Mechanical Engineers (ASME):
  - 1. ASME A13.1-81 Scheme for the Identification of Piping Systems (R1993).

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2. ASME B16.5-88 Pipe Flanges and Flanged Fittings.
3. ASME B16.22-95 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.25-92 Buttwelding Ends.
5. ASME B31.3-96 Process Piping.

B. American Society for Nondestructive Testing (ASNT):

1. ASNT-SNT-TC-1A-92 Personnel Qualifications and Certification Recommended Practice, December 1992 Edition.

C. American Society for Testing and Materials (ASTM):

1. ASTM-A53-96 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM-A105/  
A105M-96 Standard Specification for Carbon Steel Forgings for Piping Applications.
3. ASTM A126-95 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
4. ASTM A182/  
A182M-96 Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
5. ASTM A193/  
A193M-Rev. A-96 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
6. ASTM-A194/  
A194M-96 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
7. ASTM-A216/  
A216M-93 Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service.

- 8. ASTM-A234/  
A234M Rev. A-96      Standard Specification for  
Piping Fittings of Wrought  
Carbon Steel and Alloy Steel  
for Moderate and Elevated  
Temperatures.
- 9. ASTM-A307-94      Standard Specification for  
Carbon Steel Bolts and Studs,  
60,000 Psi Tensile Strength.
- 10. ASTM B32-96      Standard Specification for  
Solder Metal
- 11. ASTM B61-93      Standard Specification for  
Steam or Valve Bronze  
Castings.
- 12. ASTM B62-93      Standard Specification for  
Composition Bronze or Ounce  
Metal Castings.
- 13. ASTM B88-96      Standard Specification for  
Seamless Copper Water Tube.
- 14. ASTM B828-92      Standard Specification for  
Making Capillary Joints by  
Soldering of Copper and Copper  
Alloy Tube and Fittings.

D. American Welding Society (AWS):

- 1. AWS A5.1-91      Carbon Steel Electrodes for  
Shielded Metal Arc Welding.

E. Ohio Plumbing Code - January 1993.

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01011.
- B. Product Data for pipe, fittings, valves, and  
accessories.
- C. Shop drawings for shop-fabricated piping assemblies,  
including spool piece drawings.
- D. Installation, maintenance, and operation instruction  
manuals for valves and accessories.

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- E. Certificates of conformance that material and equipment meet specification requirements.
  - F. Test procedures for required testing. Test procedures shall include criteria for acceptable performance.
  - G. Procedures for repair or replacement of piping failing tests and/or examination.
- 
- H. Pressure test and examination reports.
  - I. Welder and examiner qualifications, procedure qualification records, and welding procedure specifications.

#### 1.6 QUALITY ASSURANCE

- A. Except where more stringent requirements are specified or indicated, the work specified herein shall conform to ASME B31.3.
- B. Welding Procedures and Qualifications
  - 1. Fabrication, assembly, and erection shall be in accordance with ASME B31.3.
  - 2. Welder qualifications shall be made available to, and approved by, FDF.
  - 3. Nondestructive testing personnel qualifications shall be in accordance with ASNT SNT-TC-1A.
- C. Inspection, Examination, and Testing
  - 1. Inspection, examination, and testing shall be in accordance with ASME B31.3.
  - 2. FDF shall be given advance written notification prior to any testing.
  - 3. A written report of the examination and testing shall be submitted to FDF following the successful completion of examination and testing.

## 1.7 DELIVERY, STORAGE, AND HANDLING

### A. Packaging

1. Materials shall be cleaned to remove chips, slag, weld spatter, oil, grease, debris, and other foreign material prior to packaging for shipment. Openings shall be covered, capped, or plugged to prevent damage and the ingress of foreign materials during shipment and storage. Tape alone shall not be used for sealing openings.

### B. Storage and Handling

1. Piping materials and prefabricated assemblies shall be stored off the ground and handled with care so that physical damage, contamination, or corrosion of the piping materials does not occur. End seals of pipe, flange covers, valve covers, and similar protection shall not be removed until necessary for cleaning, fabrication, inspection, and erection.
2. Welding rods and electrodes shall be stored, handled, and identified to ensure the use of the proper welding rod. Electrode ovens for the storage of low-hydrogen welding rods shall be used.

## PART 2 PRODUCTS

### 2.1 PRODUCTS/EQUIPMENT

#### A. Piping and Valve Specification

1. Piping materials and valves shall meet the requirements indicated on the piping material data sheets in Attachment A.
2. For underground piping, see Sections 02667 and 02668.
3. Provide one spare valve for each size and type installed.
4. Air Release Valve installed in the Lift Station is specified on the drawings.

- B. Post Hydrant: Hydrant shall be exposed, non-freeze post type hydrant. Complete with bronze casing and cast aluminum casing guard, all bronze interior parts, bronze seat, and replaceable seat washer and non-turning operating rod and operating key. Drain port shall be tapped into housing.

## 2.2 LABELING

### A. Valve Identification

1. Each valve shall be identified with the unique valve number and description, as shown on the P&IDs.
2. The tag shall not be attached to any part of the valve which may interfere with valve operation.
3. Valve identification tags on insulated valves shall be located outside the insulation jacketing and be easily accessible for inspection.
4. Label size shall be based on using 1/2-inch letters.
5. Labels shall be constructed of nonreflective corrosion-resistant materials, with good contrast and legibility.

### B. Pipe Identification

1. Identify the flow medium and the flow direction for piping systems including insulated pipe by labeling adjacent to each valve, adjacent to abrupt pipe directional change, and at intervals of 50 feet along exposed pipe. Pipes shall be labeled as indicated on the P&IDs and in accordance with ASME A13.1.
2. Content, size, material type, line number, and insulation requirements for each pipeline shall be identified on drawings as follows. Refer to the P&ID symbols and legend for additional information.

Example                      ST - 4" - A - 1000 - ET

<u>Medium Code</u>	<u>Size</u>	<u>Material Code</u>	<u>Line Number</u>	<u>Insulation</u>
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ST	4"	A	1000	ET
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C. Product Marking

1. Piping materials shall be marked in accordance with the applicable ASTM specification as indicated on the piping material data sheets in Attachment A.
2. Welding rod and electrode packages shall be marked in accordance with AWS A5.1.
3. Welding rods and electrodes shall be identified in accordance with AWS A5.1. In addition, welding rods 1/8-inch diameter and over shall be marked or stamped with positive identification marks at intervals of not more than 18 inches. Such marks shall include the classification number of the welding rod and the trade designation of the manufacturer.

**PART 3 EXECUTION**

**3.1 FIELD CONDITIONS**

- A. Verify that field conditions are acceptable and are ready to receive work.

**3.2 PREPARATION**

- A. Primer Application
  1. Non-insulated carbon steel piping shall be prime coated after fabrication.
- B. Ream copper pipe and tube ends, and remove burrs.

**3.3 ERECTION/INSTALLATION**

- A. Layout, Cutting, and Fitting Up
  1. Piping shall be Category D fluid service under ASME B31.3.
  2. Assembled piping shall be installed without springing, forcing, or cold bending. Cutting or otherwise weakening structural members to facilitate piping installation shall not be permitted.
  3. Butt-welded pipe shall be beveled in accordance with ASME B16.25.

4. Install valves with stems upright or horizontal, not inverted.
5. Slope field-routed piping and tubing, and arrange to drain at all low points.

B. Welding

1. Welding electrodes shall be in accordance with AWS A5.1.
2. ~~Socketwelds shall be made by shielded metal arc or gas tungsten arc welding process.~~
3. Socketweld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1/16 inch or no more than 1/8 inch.
4. Field welding shall be minimized through maximum use of shop-fabricated piping assemblies.
5. Arc strikes and weld starts shall not be made on the base metal outside the weld groove nor inside an area which will be encompassed by a fillet or socket weld. Inadvertent arc strikes outside a weld zone shall be removed by grinding or filing, and the arc strike area shall be visually examined under 5X magnification.
6. Soldering shall be in accordance with ASTM B828.

C. Flanged Joints

1. Flange isolation kits shall be used between all dissimilar metal flanges.
2. The mating surfaces of the flanges shall be in a plane that is perpendicular to the axis of the pipe. Flanges shall be rotated so that the bolt holes straddle the vertical flange centerline. Gaskets shall be evenly centered between the flange faces with ring-type gaskets engaging fully upon raised-face flanges. Flanges shall mate flush and the bolts shall be tightened uniformly to draw the flanges evenly and firmly upon the gasket. Bolts shall be torqued within the flange manufacturer's recommended range and tightening sequence.
3. Where a raised-face flange mates with a flat-face flange, it shall be substituted with a flat-face

flange of the material type specified on the attached Piping Material Data Sheet.

4. Flat ring-type gaskets shall be used between steel flanges equipped with raised serrated faces.
5. Where metallic flanges are bolted to non-metallic flanges, both shall be flat-faced flanges. Full-face gaskets shall be used.
6. When piping, valves, fittings, or equipment having cast iron flanges are used, mating flanges shall be flat faced with full-faced gaskets.
7. Flanged joints shall be made with new gasket and bolting materials. Bolts and nuts damaged during installation shall be replaced.

- D. At least 5 percent of fabricated piping shall be visually examined by an examiner qualified and certified in accordance with ASNT SNT-TC-1A.

### 3.4 QUALITY CONTROL

#### A. Hydrostatic Testing

1. Piping systems shall be hydrostatically leak tested in accordance with ASME B31.3, Chapter VI.
2. Pressure vessels, equipment, and instruments shall not be included in these tests if they will be damaged by the test pressure.
3. Equipment which is not to be subjected to the pressure test shall be disconnected from the piping and a pipe spool inserted in its place, or the equipment may be isolated by way of a single-line blind. Valves may be used provided that the valve is suitable for the proposed test procedure.
4. Hydrostatic test pressures shall be 1.5 times the design pressure, as shown in the following table:

<u>SERVICE</u>	<u>MEDIUM CODE</u>	<u>MATERIAL CODE</u>	<u>DESIGN PRESSURE (psig)</u>	<u>TEST PRESSURE (psig)</u>
Potable Water	DW	A, C1	100	150
Stormwater	ST	A	100	150

5. Leak testing shall not start until the testing procedure has been approved by FDF.
6. Connections/joints (including welds) shall be left uninsulated, unpainted, and exposed for examination for leakage during testing.
7. The piping system shall be examined prior to leak testing to ensure that connections are tight.
8. Test pressure gauges shall be calibrated no more than 90 days prior to the hydrostatic leak test.  
Gauges shall be selected so that the test pressures are at the mid-range of the gauge. Documentation shall be maintained and made available showing reliability of calibrated equipment.
9. Every precaution shall be taken during testing to ensure personnel safety.
10. Pressure gauges shall not be subjected to pressure in excess of their scale range.
11. Control valves (unless being tested) shall be set and maintained in the full OPEN position.
12. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.
13. Joints found to be defective shall be repaired and retested. Retest pressures shall be the same as those originally specified for the test.
14. Hydrostatic test pressures shall not be applied until the piping system and the testing medium have reached thermal equilibrium.
15. High-point vents and low-point drains shall be provided for hydrostatic tests.

B. Plumbing shall be inspected and tested to ensure compliance with the Ohio Plumbing Code.

### 3.5 CLEANING

#### A. System Cleaning and Flushing

1. The interior and exterior of pipe shall be kept clean at all times.

B. Disinfection of Water Distribution Systems: See  
Section 02667.

END OF SECTION



**ATTACHMENT A**

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**PIPING MATERIAL DATA SHEETS**

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000212

**PIPING MATERIAL DATA SHEET**
**MAT'L CODE**  
**(SPEC)**  
**PAGE 1**
**A**  
**OF 3**
**RATING: CLASS 150**  
**FACING: RF**  
**MATERIAL: CARBON STEEL**
**CORROSION ALLOWANCE: 0.125"**  
**PRESSURE LIMIT: PER ASME/ANSI B16.5**  
**TEMPERATURE LIMIT: -20°F TO 750°F**

CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			PIPE		
		1/2" - 2"	SEAMLESS CARBON STEEL, ASTM A53 GRADE B, EXTRA STRONG, PLAIN ENDS		
		2-1/2" - LARGER	SEAMLESS CARBON STEEL, ASTM A53 GRADE B, STANDARD WEIGHT, BEVELED ENDS		
			FLANGES		
		1/2" - 2"	CLASS 150, CARBON STEEL, RF, ASTM A105, SOCKETWELD (XS BORE)		
		2-1/2" - LARGER	CLASS 150, CARBON STEEL, RFSF, ASTM A105, WELD NECK (STANDARD WEIGHT BORE)		
		1/2" - LARGER	CLASS 150, BLIND, CARBON STEEL, ASTM A105, RFSF		
			FITTINGS		
		1/2" - 2"	CLASS 3000, CARBON STEEL, ASTM A105, SOCKETWELD		
		1/2" - 2"	CLASS 3000, THREADED CARBON STEEL, ASTM A105; THREDOLET CAP	1, 4 1	
			PLUG, ROUNDHEAD PLUG, HEX HEAD	1 4	
		2-1/2" - LARGER	SEAMLESS CARBON STEEL, BUTT WELD ENDS, ASTM A234 GRADE WPB, STANDARD WEIGHT		
			SWAGES		
		1/2" - 8"	SCHEDULE 80 CARBON STEEL, ASTM A234, GRADE WPB, PREPARE ENDS AS REQUIRED (BEVELED, PLAIN OR THREADED)	2	
			GASKETS		
		1/2" - LARGER	TEFLON, 1/8 INCH THICK		
			BOLTING		
			STUD BOLTS WITH 2 HEAVY HEX NUTS, ASTM A193 GRADE B7/ASTM A194 GRADE 2H		

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PIPING MATERIAL DATA SHEET				MAT'L CODE (SPEC) PAGE 2	A OF 3
RATING: CLASS 150 FACING: RF MATERIAL: CARBON STEEL		CORROSION ALLOWANCE: 0.125" PRESSURE LIMIT: PER ASME/ANSI B16.5 TEMPERATURE LIMIT: -20°F TO 750°F			
CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			GATE VALVES		
		1/2" - 2"	CLASS 800, CARBON STEEL, ASTM A105, SOCKETWELD ENDS, OS&Y, BOLTED BONNET, SOLID WEDGE, 12% CR TRIM.	5	
		2-1/2" - LARGER	CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF FLANGE, 11-13 CR TRIM, OS&Y.	5	
			BALL VALVES		
		1/2" - 2"	1500 PSI WOG, CARBON STEEL, ASTM A216 GRADE WCB, THREE PIECE, SOCKETWELD, CHROMIUM PLATED BALL, TFE SEATS, LEVER OPERATOR, APOLLO 83-600 SERIES OR EQUAL	5	
		2-1/2" - 4"	CLASS 150, CARBON STEEL, ASTM A216, GRADE WCB, RFSF FLANGE, CHROME PLATED BALL, TFE SEATS, WRENCH OPERATOR, APOLLO 88-200 SERIES OR EQUAL.	5	
		6" - LARGER	CLASS 150, CARBON STEEL, ASTM A216, GRADE WCB, RFSF FLANGE, CHROME PLATED BALL, TFE SEATS, GEAR OPERATOR, APOLLO 88-200 SERIES OR EQUAL.	5	
			CHECK VALVES		
		2-1/2" - LARGER	CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF, FLANGE, CHROME TRIM, BOLTED COVER, SWING TYPE, LUNKENHEIMER FIG. 1572 OR EQUAL	3	
			PIPE NIPPLES		
			CARBON STEEL, ASTM A53, GRADE B		
		1/2" - 2"	SCH 160, TBE, SMLS 3" LONG		
		1/2" - 2"	SCH 160, TBE, SMLS 6" LONG		
		1/2" - 2"	SCH 160, POE-TOE, SMLS 3" LONG		
		1/2" - 2"	SCH 160, POE-TOE, SMLS 6" LONG		
			NOTES		
			1. USE FOR UNVALVED VENTS AND DRAINS.		
			2. USE SWAGES WHERE SMALL END IS 2" AND SMALLER. USE WELD REDUCER WHERE SMALL END IS 2-1/2" AND LARGER.		
			3. INSTALL IN HORIZONTAL POSITION OR WITH FLOW UP.		
			4. USE FOR PROCESS DRAINS.		
			5. EQUIP VALVE WITH LOCKING DEVICE WITH NOT LESS THAN 3/8" DIAMETER HOLE FOR LOCK.		

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## PIPING MATERIAL DATA SHEET

MAT'L CODE C1  
(SPEC)  
PAGE 3 OF 3

RATING: CLASS 150  
FACING: N/A  
MATERIAL: COPPER

CORROSION ALLOWANCE: N/A  
PRESSURE LIMIT: 150 psig  
TEMPERATURE LIMIT: -20°F TO 750°F

CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			TUBING		
		1/4" - 2"	SEAMLESS COPPER, ASTM B88, TYPE L, HARD DRAWN		
			FITTINGS		
		1/4" - 2"	WROUGHT COPPER AND BRONZE, ASME B16.22, 150 PSIG		
			FLANGES		
		1" - 2"	BRONZE, ASME B16.22, 150 PSIG, SLIP-ON FLANGES		
			JOINTS		
			SOLDER, ASTM B32, GRADE 95TA		

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SECTION 15090  
PIPING SUPPORTS AND ANCHORS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Piping supports, anchors, and accessories.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.
- C. Section 15060 - Pipe, Fittings, Valves, and Accessories.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES, CODES AND STANDARDS**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36/A36M-96 Standard Specification for Carbon Structural Steel.
- B. American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME):
  - 1. ANSI/ASME B31.3-96 Process Piping.
- C. Manufacturers Standardization Society (MSS):
  - 1. MSS-SP-58-93 Pipe Hangers and Supports - Materials, Design, and Manufacture.
  - 2. MSS-SP-69-91 Pipe Hangers and Supports - Selection and Application.
  - 3. MSS-SP-89-91 Pipe Hangers and Supports - Fabrication and Installation Practices.

- D. American Welding Society (AWS):
1. AWS A5.1-91 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
  2. AWS D1.1-96 Structural Welding Code - Steel, 13th Edition.

## 1.5 SYSTEM DESCRIPTION

- A. Design Requirements
1. Pipe anchors, guides, and auxiliary steel shall be of bolted or welded construction incorporating a design safety factor of five.
  2. Anchors and guides shall be used to prevent excessive forces or moments on pipe or equipment caused by hydraulic surges.
  3. Hangers and support types for lines shall be selected to withstand static and dynamic load conditions and shall take into consideration limitations imposed by the surrounding structures, equipment, adjacent piping, etc. Consideration shall be given to the following loads:
    - a. Weight of the pipe, valves, fittings, insulation materials, hanger components, and normal fluid contents.
    - b. Loads imposed during erection.
  4. Support Spacing:
    - a. Hangers and supports shall be spaced in accordance with ASME B31.3 and Attachment A.
  5. Restrictions:
    - a. Pipe support assemblies shall be used only for supporting pipelines. Electrical trays, instrument trays, cable, and tubing shall be supported from separate assemblies unless written approval has been received from FDF. Pipe hanger rods or supports shall not pass through ducts nor through electrical or instrument trays.
  6. Combination Supports:
    - a. Where the piping design incorporates multiple horizontal pipelines with the bottom of the pipelines at the same elevation, rack-type supports shall be used. Where multiple

pipelines are supported on a single support member, consideration shall be given to the difference in expansion of the pipelines and possible resultant misalignment of the support during normal operation.

7. Unit Support:

- a. Where single horizontal pipelines are to be supported, the selection of the pipe attachment shall be based on the application, considering workability, function, strength, and economics. This attachment may be a pipe clamp, clevis, U-bolt, double-rod roll, or other pipe attachment best suited for the condition. The movement of the pipe due to hydraulic surges and other sources shall be considered. The attachments between the pipe and the supporting structure (usually hanger rod) shall be able to swivel at the ends to accommodate a 4-degree movement of the pipe.

8. Structural Integrity:

- a. The supports shall be designed and installed so that they cannot become disengaged by movements of the supported pipe. A lock nut shall be used to prevent turning and disengagement.

1.6 SUBMITTALS

- A. Submittals shall be in accordance with Section 01011.
- B. For piping supports and anchors for piping 2 inches in diameter and smaller: shop drawings which indicate support type and location, arrangement, dimensions, materials, weld details, and anchor details.
- C. Welder and examiner qualifications, procedure qualification records, and welding procedure specifications in accordance with AWS D1.1.

**1.7 QUALITY ASSURANCE**

- A. Pipe anchors, guides, and auxiliary steel shall be of bolted or welded construction. Welded construction shall comply with AWS D1.1.

**1.8 DELIVERY, STORAGE, AND HANDLING**

**A. Packaging**

1. Materials shall be cleaned to remove chips, slag, weld spatter, oil and grease, debris, and other foreign matter prior to packing for shipment.

**B. Storage and Handling**

1. Piping support materials and piping hanger systems shall be stored off the ground and handled with care so that physical damage or contamination of the materials does not occur.
2. Welding rods and electrodes shall be stored, handled, and identified to ensure the use of proper welding rod. Electrode ovens for the storage of low-hydrogen welding rods shall be used.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Hangers, supports, and component parts shall be constructed of galvanized carbon steel and comply with MSS-SP-58 and MSS-SP-69. Standard, commercially available hangers shall be used wherever possible.
- B. ASTM A36 steel shall be used for plate and structural shape support components.
- C. Expansion Anchors: Drilled expansion bolts for securing steel to concrete.
- a. Kwik Bolt, by Hilti, Inc.
- b. Parabolt, by Molly Fastener Group.
- c. Wedge Anchors, by ITW Ramset/Red Head.



## 2.2 FABRICATION

### A. Welding

1. Welding shall be in accordance with AWS A5.1 and AWS D1.1.

### B. Shop Assembly

1. Any parts made in the fabricator's shop shall be completely shop assembled and painted, as far as practical, prior to shipment to the site.

## 2.3 LABELING

### A. Product Marking

1. Welding rods and electrodes shall be identified with at least one imprint per rod showing an AWS classification number in accordance with AWS A5.1. In addition, welding rods 1/8 inch in diameter and over shall be marked or stamped with positive identification marks at intervals of not more than 18 inches. Such marks shall include the classification number of the welding rod and the trade designation of the manufacturer. Filler metal requirements shall conform to AWS A5.1.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### A. Protection

1. Welding/fabricating activities shall be protected from inclement weather.

#### B. Painting

1. Structural steel pipe support material systems shall be prime and finish coated after fabrication.

### 3.2 ERECTION/INSTALLATION

#### A. Installation

1. Hanger and support components shall be installed in accordance with MSS-SP-89.

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B. Structural Connections for Pipeline Supports

1. Locations: Pipeline supports and/or hangers shall be attached to structural members. The supports shall be located at the following places and at intermediate points so that the maximum support spacing is not exceeded:
  - a. For changes in direction on horizontal or sloped lines, refer to the attached allowable pipe spans chart.
  - b. Within 2 feet on one side of valves on horizontal or sloped lines.
2. Cold Lines: Hanger rods supporting cold pipelines, or lines whose point of support does not move, may be bolted directly to angle, beam, or supporting members.
3. Prohibited Attachments: Pipelines shall not be attached to the following:
  - a. Grating.
  - b. Other pipe hangers or other pipes.
4. Supports shall be provided to avoid the need for temporary supports in the following cases:
  - a. Where regular maintenance necessitates the removal of equipment.
  - b. Where flanged connections must be broken to remove or insert spectacle blinds.

3.3 ADJUSTING

- A. At Pumps: Where required, the suction piping and discharge piping adjacent to pumps shall be supported with an adjustable support.
- B. Riser Guides: Risers that may sway or vibrate from pump pulsations or mechanical equipment operation shall be guided. The guides/braces shall prevent movement resulting from equipment operation/vibration, but shall not limit or restrain movement of pipe due to thermal expansion. On overflow lines, a brace or restraint shall be installed near the discharge.

C. Vertical Adjustment:

1. Rod-type hangers shall be provided with a means of vertical adjustment after erection. If a turnbuckle is used, the right hand thread shall be at the top, so that turning to the right will raise the pipe.

D. Riser Piping:

1. Where practical, riser piping shall be supported independently of the connected horizontal piping. Pipe support attachments to riser piping shall be by riser clamps and/or lugs welded to the pipe.

END OF SECTION

**ATTACHMENT A**

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**ALLOWABLE PIPE SPANS**

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PARSONS

## Engineering Department Design Guide

Design Guide Number

DSG-PD-602

App

Date

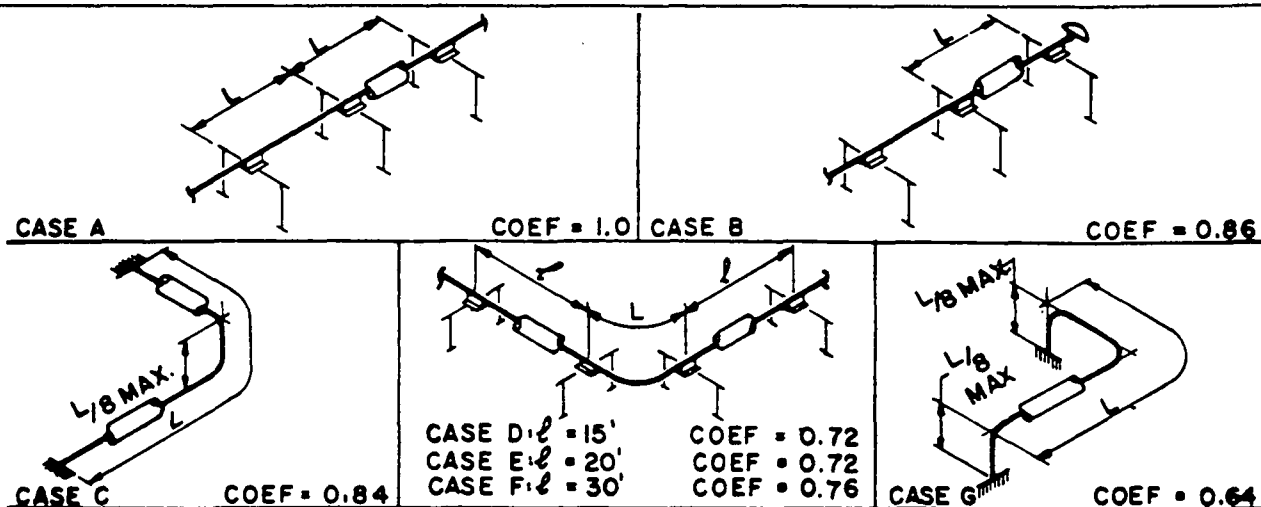
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## ALLOWABLE PIPE SPANS



## Notes:

1. The limiting factors are deflection and weight stress. Pipe span not entered if weight stress of 6,000 pounds per square inch (psi) is exceeded.
2. The pipe spans are based on carbon steel pipe with modulus of elasticity of  $30 \times 10^6$  psi. This chart can be applicable to alloy pipe.
3. Deflection is based on a compromise between a beam with fixed-ends and for a free-ended beam,  $d = 17.1 (w1^4/EI)$ .
4. This chart is adequate for standard-wall and extra-strong walled pipe.
5. Boxed figures represent Parsons standard. Job instructions may allow deviation.
6. When using Cases B, C, D, E, F, and G, multiply pipe span by their coefficient.
7. These spans are the maximum to be used under American National Standards Institute B31.3, Piping. Design conditions and other codes should be investigated before using these spans.

PIPE SIZE	1	1½	2	3	4	6	8	10	12	14	16	18	20	24	DEFL
BARE PIPE	—	—	—	—	—	—	—	36	38	42	45	47	50	54	1/4
	14	17	19	24	27	33	38	43	46	49	52	55	58	64	1/2
	15	18	21	25	29	35	40	46	49	52	55	58	62	68	5/8
	16	19	22	26	30	37	42	48	52	55	58	62	65	71	3/4
	17	21	23	28	32	40	45	—	—	—	—	—	—	—	1
BARE PIPE + WATER	—	—	—	—	—	—	—	31	33	35	36	37	39	42	1/4
	14	17	19	22	25	29	33	36	39	40	42	44	46	48	1/2
	14	18	20	23	26	31	35	39	41	43	45	47	48	52	5/8
	15	19	21	24	27	33	37	41	43	45	47	49	51	—	3/4
	16	20	22	26	29	35	40	—	—	—	—	—	—	—	1
PIPE + 2" INSUL.	—	—	—	—	—	—	—	34	36	39	42	44	47	52	1/4
	12	15	17	22	25	31	36	41	42	46	50	52	56	61	1/2
	13	16	18	23	26	33	38	43	45	49	53	56	59	65	5/8
	13	17	19	24	27	35	40	45	47	52	55	58	62	68	3/4
	14	18	20	26	28	37	42	—	—	—	—	—	—	—	1
PIPE + 2" INSUL. + 0.8 WATER	—	—	—	—	—	—	—	31	33	35	36	37	39	42	1/4
	12	15	16	20	23	29	33	36	39	40	42	44	46	48	1/2
	12	16	17	22	25	31	35	39	41	43	45	47	48	52	5/8
	13	17	18	23	26	32	36	41	43	45	47	49	51	—	3/4
	14	18	20	25	28	34	39	—	—	—	—	—	—	—	1

SECTION 15160  
LIFT STATION PUMPS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Three automatically controlled lift station pumps and two non-installed spare pumps.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.  
B. Section 01011 - Submittals Listing.  
C. Section 15170 - Motors.  
D. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI):  
1. ANSI B16.1-89 Cast Iron Pipe Flanges and Flanged Fittings.

**1.5 SUBMITTALS**

- A. Support Literature:  
1. Submit dimensional drawings with size, weight, ratings, materials of construction, pump curves, completed pump data sheet, and test procedures from the pump manufacturer for the pump and related equipment specified herein.  
2. Installation, Operation, and Maintenance Manual:  
a. The pump manufacturer shall supply a complete set of comprehensive written instructions to enable an operator to properly operate and maintain the equipment supplied. Content of

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the instructions shall assume the operator is familiar with pumps, motors, piping, and valves, but that the operator has not previously operated nor maintained the exact equipment supplied.

b. The instructions shall be prepared as a system manual applicable solely to the pump equipment and related devices supplied by the manufacturer, as specified herein.

c. The instructions shall include, but not be limited to, the following:

- (1) Descriptions of, and operating instructions for, each major component of the complete pump package as supplied.
- (2) Instructions on operation of the pump and pump controls in intended modes of operation.
- (3) Instruction for adjustments which must be performed at initial start-up of pump equipment, adjustments required after the replacement of liquid level control system components, and adjustments as required in the course of preventative maintenance as specified by the manufacturer.
- (4) Service instructions for major components not manufactured by the pump package manufacturer, but supplied by the manufacturer in accordance with the specifications. In such case, the literature supplied by the actual manufacturer shall be incorporated as appendices.
- (5) Electrical schematic diagram of the pump and control package.
- (6) Layout drawings of the pump package as supplied showing the location of submersible pumps, baseplates, and guide assemblies. Drawings shall provide necessary information to ensure proper installation and alignment of the guides and baseplate to the pump.

**PART 2 PRODUCTS****2.1 MANUFACTURER**

- A. KSB, Inc., or equal.

**2.2 PUMPS**

- A. See Attachment A - Pump Data Sheets.
- B. See Section 15170 for Motor data.
- C. Impeller shall be of cast iron and precision balanced. Balancing shall not deform or weaken the impeller. Impeller fasteners shall be non-corroding.
- D. Design shall provide for proper balance of pump and guide shoe from the discharge connection while using a single lift chain.
- E. Components: Other major pump components such as stator housing, seal housing, and bearing brackets shall be of structural grade steel or cast iron. Exposed fasteners and lock washers shall be of stainless steel.
- F. Shaft Seal:
1. The pump shaft shall be sealed against leakage by a double mechanical seal.
  2. The rotating seal faces shall be lubricated from an oil-filled reservoir between pump and motor, the oil serving as both lubricating and cooling media. The reservoir shall have separate oil fill and drain plugs to ensure accuracy when measuring lubricant level, and for ease of maintenance.
  3. Seal shall require no special maintenance or routine adjustment. However, it shall be easily inspected or replaced. No seal damage shall result from operating the pump for short periods without liquid.



## 2.3 DISCHARGE

### A. Description:

1. Each pump shall be furnished with a submersible discharge connection system to permit removal and installation of the pump without the necessity of an operator entering the wet well. The design shall ensure an automatic and firm connection of the pump to the discharge piping when lowered into place.

### B. Baseplate:

1. A cast iron base with integral guide system pilots shall be provided along with all hardware and anchor bolts required for permanent installation to the wet well floor. The base shall be designed with an integral 90-degree elbow for connection to the vertical discharge piping utilizing standard ANSI B16.1 Class 125 flanges.

### C. Discharge Connection:

1. Each pump shall be provided with a replaceable cast iron guide shoe attached to the pump discharge flange. A replaceable seal shall be provided as an integral part of the guide shoe to form a seal with the baseplate connection and eliminate the possibility of leakage and erosive wear during operation. The seal shall contact mating faces in a static position and shall have adequate flexibility to flex under pumping pressure to increase seal efficiency. Metal-to-metal contact at the discharge connection shall not be acceptable.

### D. Guide Rail System and Method of Operation:

1. Schedule 40 stainless steel guide rail pipe or stainless steel cable shall be provided for each pump.
2. Upper guide system brackets and a lifting chain shall be furnished for each pump. Bottom pilots shall be an integral part of the baseplate for ease of installation and proper alignment.

3. The guide shoe shall direct the pump down the guide system and onto the discharge connection in a simple linear movement. The design shall ensure that the buildup of sludge and grease on guide rails will not present problems during the lifting operation. The guide shoe shall be designed with integral hooks at the top to transmit the full weight of the pump to the baseplate flange. No portion of the pump shall be supported directly on the bottom of the wet well, guide system, or lifting chain.
4. An eyelet shall be provided at the upper end of the lifting chain for attaching to the wet well access frame.
5. Bolts, machine screws, nuts, washers, and lockwashers for complete assembly of the guide rails and discharge elbow shall be stainless steel.
6. Adjust final length of guide and lifting systems in the field.

#### **2.4 LABELING**

- A. Equipment identification: Pumps shall be provided with a permanently attached stainless steel nameplate indicating equipment name, number, model number, and rated capacity. Lettering shall be manufacturer's standard size and shall be stamped.

### **PART 3 EXECUTION**

#### **3.1 FIELD CONDITIONS**

- A. Verify that field conditions are acceptable and are ready to receive work.

#### **3.2 ERECTION/INSTALLATION/APPLICATION**

- A. The installation of the equipment shall be in accordance with the manufacturer's installation manual.

- B. A copy of the manufacturer's installation and service manual for each piece of the equipment shall be available at the site.

### **3.3 QUALITY CONTROL**

- A. Tests: Acceptance operating tests shall be performed after installation. Adjust or replace the equipment to meet the specification requirements and retest the equipment.
- B. Inspection: Notify FDF of testing and inspection activities prior to the start of all tests and/or inspections.

### **3.4 MANUFACTURER ASSISTANCE**

- A. The manufacturer shall provide installation supervision and start-up assistance. Service assistance shall be in accordance with the manufacturer's warranty.

### **3.5 DEMONSTRATION**

- A. Demonstrate ability to meet full range of operating flow rates and operating points as shown on pump curves.

**END OF SECTION**

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**ATTACHMENT A**  
**PUMP DATA SHEETS**

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## PUMP DATA SHEET

PROJECT TITLE: Waste Units Remediation - SWU				PROJECT ORDER: 165				
PUMP NAME: SWRB PMP-1 - include name for spare				QUANTITY: 1 + 1 spare				
TYPE PUMP: Submersible centrifugal				DRAWING NUMBER 92X-5900-N-00290				
TYPE DRIVER: Submersible electric motor		SUPPLY W/PUMP		X YES		NO		
MANUFACTURER AND MODEL NO.: KSB, Inc., Model KRT K100-400, or equal				EQUIP NO.: PMP-1 & include name for spare				
OPERATING CONDITIONS								
FLUID PUMPED: STORMWATER				AT A PUMPING TEMPERATURE OF: 60 °F				
SPECIFIC GRAVITY: 1.0 AT 60°F		AT P.T.		VISCOSITY:		AT P.T.		
SOLIDS IN FLUID: 1-5 WT%		DENSITY: NA		SIZE: ≤ 1/2" dia.		ABRASIVE: NO		
NATURE OF SOLIDS: NA				FLUID VAPOR PRESSURE:		FT. of FLUID @ P.T.		
PUMP SPECIFICATIONS								
TYPE PUMP: Centrifugal, direct-connected				NO. STAGES: 1		RPM: 3600 max.		
TYPE IMPELLER: Open				SIZE: IN.		MAX SIZE: IN.		
EFFICIENCY AT DESIGN CAPACITY: (min) %		BHP @ DESIGN CAPACITY:		MAXIMUM BHP:		50		
TYPE BEARINGS: Oil-lubricated, anti-friction								
TYPE COUPLING:				LUBRICATION:				
TYPE OF SEAL: Double Mechanical								
CONNECTIONS - SIZE & RATING								
SUCTION: IN.		LB. Flange		DISCHARGE: 4 IN.		Class 125 Flange		
VENT: IN.		LB.		DRAIN: IN.				
CONSTRUCTION MATERIALS								
RESTRICTIONS:								
CASING: Cast iron				IMPELLER: Cast iron				
SHAFT: Stainless steel				SHAFT SLEEVE: Stainless steel				
CASE RING:				IMP. RING:				
DISCHARGE ELBOW: Cast iron				RELIEF VALVE:				
ELECTRIC MOTOR								
VOLTS	PHASE	HERTZ	H.P.	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE
460	3	60		YES				
REMARKS: 1) Vendor shall complete data sheet as required. 2) Provide one set of recommended pump spare parts.								

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## PUMP DATA SHEET

PROJECT TITLE: Waste Units Remediation - SWU						PROJECT ORDER: 165			
PUMP NAME: SWRB PMP-2 - include name for spare						QUANTITY: 1 + 1 spare			
TYPE PUMP: Submersible centrifugal						DRAWING NUMBER 92X-5900-N-00290			
TYPE DRIVER: Submersible electric motor		SUPPLY W/PUMP							
MANUFACTURER AND MODEL NO.: KSB, Inc., Model KRT K40-250, or equal						EQUIP NO.: PMP-2 & include name for spare			
<b>OPERATING CONDITIONS</b>									
FLUID PUMPED: STORMWATER						AT A PUMPING TEMPERATURE OF: 60 °F			
SPECIFIC GRAVITY: 1.0 AT 60°F		AT P.T.		-VISCOSITY:		AT P.T.			
SOLIDS IN FLUID: 1-5 WT%		DENSITY: NA		SIZE: ≤ 1/2" dia.		ABRASIVE: NO			
NATURE OF SOLIDS: NA				FLUID VAPOR PRESSURE:		FT. of FLUID @ P.T.			
<b>PUMP SPECIFICATIONS</b>									
TYPE PUMP: Centrifugal, direct-connected						NO. STAGES: 1		RPM: 3600 max.	
TYPE IMPELLER: Open						SIZE: IN.		MAX SIZE: IN.	
EFFICIENCY AT DESIGN CAPACITY: (min) %				BHP @ DESIGN CAPACITY:		MAXIMUM BHP: 17			
TYPE BEARINGS: Oil-lubricated, anti-friction									
TYPE COUPLING:						LUBRICATION:			
TYPE OF SEAL: Double Mechanical									
<b>CONNECTIONS - SIZE &amp; RATING</b>									
SUCTION: IN. LB. Flange				DISCHARGE: 2 IN. Class 125 Flange					
VENT: IN. LB.				DRAIN: IN.					
<b>CONSTRUCTION MATERIALS</b>									
RESTRICTIONS:									
CASING: Cast iron				IMPELLER: Cast iron					
SHAFT: Stainless steel				SHAFT SLEEVE: Stainless steel					
CASE RING:				IMP. RING:					
DISCHARGE ELBOW: Cast iron				RELIEF VALVE:					
<b>ELECTRIC MOTOR</b>									
VOLTS	PHASE	HERTZ	H.P.	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE	
460	3	60		YES					
REMARKS: 1) Vendor shall complete data sheet as required. 2) Provide one set of recommended pump spare parts.									

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# PUMP DATA SHEET

PROJECT TITLE: Waste Units Remediation - SWU						PROJECT ORDER: 165		
PUMP NAME: SWRB PMP-3						QUANTITY: 1		
TYPE PUMP: Submersible centrifugal						DRAWING NUMBER 92X-5900-N-00290		
TYPE DRIVER: Submersible electric motor		SUPPLY W/PUMP		X YES		NO		
MANUFACTURER AND MODEL NO.: KSB, Inc., Model KRT K40-250, or equal				EQUIP NO.: PMP-3				
OPERATING CONDITIONS								
FLUID PUMPED: STORMWATER			AT A PUMPING TEMPERATURE OF:			60 °F		
SPECIFIC GRAVITY: 1.0		AT 60°F		AT P.T.		VISCOSITY:		AT P.T.
SOLIDS IN FLUID: 1-5		WT%		DENSITY: NA		SIZE: ≤1/2" dia.		ABRASIVE: NO
NATURE OF SOLIDS: NA				FLUID VAPOR PRESSURE:		FT. of FLUID @ P.T.		
DESIGN CAPACITY: 100 GPM AT 135 FT. TH at P.T.								
DESIRE RANGE: 75 GPM TO 125 GPM								
SUCTION PRESS: NA		FT.		PSIG		DISCHARGE PRESS: FT.		PSIG
NPSH AVAIL: NA		at P.T.						
PUMP SPECIFICATIONS								
TYPE PUMP: Centrifugal, direct-connected					NO. STAGES: 1		RPM: 3600 max.	
TYPE IMPELLER: Open					SIZE:		IN. MAX SIZE: IN.	
EFFICIENCY AT DESIGN CAPACITY:			(min) %		BHP @ DESIGN CAPACITY:		MAXIMUM BHP: 17	
TYPE BEARINGS: Oil-lubricated, anti-friction								
TYPE COUPLING:					LUBRICATION:			
TYPE OF SEAL: Double Mechanical								
CONNECTIONS - SIZE & RATING								
SUCTION:		IN.		LB.		Flange		DISCHARGE: 2 IN. Class 125 Flange
VENT:		IN.		LB.		DRAIN: IN.		
CONSTRUCTION MATERIALS								
RESTRICTIONS:								
CASING: Cast iron				IMPELLER: Cast iron				
SHAFT: Stainless steel				SHAFT SLEEVE: Stainless steel				
CASE RING:				IMP. RING:				
DISCHARGE ELBOW: Cast iron				RELIEF VALVE:				
ELECTRIC MOTOR								
VOLTS	PHASE	HERTZ	H.P.	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE
460	3	60		YES				
REMARKS: 1) Vendor shall complete data sheet as required. 2) Provide one set of recommended pump spare parts.								

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SECTION 15170  
MOTORS

**PART 1      GENERAL**

**1.1          SECTION INCLUDES**

- A.      Low-voltage, three phase induction motors.

**1.2          RELATED SECTIONS**

- A.      Section 01000 - General Requirements.  
B.      Section 01011 - Submittals Listing.  
C.      Section 15160 - Lift Station Pumps.  
D.      Section 16050 - Basic Electrical Materials and Methods.  
E.      Section 16170 - Grounding and Bonding.

**1.3          REFERENCE DRAWINGS**

- A.      See Section 01012 for the Schedule of Drawings.

**1.4          REFERENCES**

- A.      American Bearing Manufacturers Association (ABMA):  
1.      ABMA 9-90                      Load Ratings and Fatigue Life  
   for Ball Bearings.  
2.      ABMA 11-90                     Load Ratings and Fatigue Life  
   for Roller Bearings.  
  
B.      Institute of Electrical and Electronics Engineers  
         (IEEE):  
1.      IEEE 112-91                    Standard Test Procedure for  
   Polyphase Induction Motors and  
   Generators.



- C. National Electrical Manufacturers Association (NEMA):
  - 1. NEMA MG 1-93 Motors and Generators.
  - 2. NEMA MG 13-84 Frame Assignments for AC Integral-Horsepower Induction Motors.
- D. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
- E. Underwriters Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directory-96.

## 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Product Data: Provide full load amps, impedances, normal and short-circuit current ratings, NEMA frame size, and additional standard nameplate data. Provide efficiency and power factor for each of 1/2, 3/4, and full load. Provide dimensional enclosure details.
- C. Test Reports: Indicate satisfactory completion of required tests and inspections. Submit results verifying performance in accordance with IEEE 112.

## 1.6 QUALITY ASSURANCE PROGRAM

- A. Conform to NFPA 70 and NEMA MG 1.
- B. Motors shall be listed in the UL Electrical Construction Materials Directory for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
  - 1. Reliance Electric.
  - 2. U. S. Motors.
  - 3. General Electric.

## 2.2

## EQUIPMENT

## A. General Construction and Requirements

1. Electrical Service: Refer to related sections of the specifications and the drawings for required characteristics. Motors shall be suitable for driven equipment.
2. Motors: Design for continuous operation at a temperature of 40 degrees C ambient, and for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
3. Visible Nameplate: Indicating motor horsepower, voltage, phase, frequency, rpm, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, serial number, and bearing numbers. Nameplate shall be stainless steel, permanently attached to the motor frame.
4. Electrical Connection: Conduit connection boxes, threaded for conduit and designed to allow for 90-degree step rotation of the conduit entrance. Oversize conduit boxes shall be provided.
5. Motor Service Factor: Furnish motors with service factors required herein. Motor size in hp shall be selected to serve the driven equipment over its full performance range as though the service factor were 1.0.
6. Motors drawing less than 250 W that are intended for intermittent service may be germane to equipment manufacturer and need not conform to these specifications.

## B. Three Phase - Squirrel Cage Induction Motors

1. Motors shall be 460 V, three phase, 60 Hz.
2. Motors shall have a 1.15 service factor or higher.
3. The motor connection diagram shall be stainless steel, permanently stamped and attached to the motor either inside the conduit box or on the same side as the conduit box.

4. Starting Torque: To be matched to the driven equipment.
5. Starting Current: Not to exceed six times full-load current.
6. Power Output, Locked Rotor Torque, Breakdown or Pullout Torque: NEMA Design B characteristics or as required by the driven equipment.
7. Design, Construction, Testing, and Performance: ~~Conform to NEMA MG-1 for Design B motors or as~~ required by the driven equipment.
8. Insulation System: Non-hygroscopic NEMA Class F or better.
9. Testing Procedure: In accordance with IEEE 112, Test Method B. Load test motors to determine freedom from electrical or mechanical defects and for compliance with performance data.
10. Motor Frames: NEMA MG 13 standard T-frames of steel, or cast iron with end brackets of cast iron.
11. Bearings: Grease lubricated, anti-friction ball bearings with housings equipped with plugged provision for prelubrication, rated for minimum ABMA 9 and 11, L-10 life of 20,000 hours.
12. Sound Power Levels: To NEMA MG 1.
13. Motors shall be high-efficiency type.
14. Motors shall be totally enclosed fan cooled (TEFC), unless specified or indicated otherwise.
15. Nominal Efficiency: Meet or exceed values in schedules as given herein at full load and rated voltage when tested in accordance with IEEE 112.
16. Nominal Power Factor: Meet or exceed values in schedules as given herein at full load and rated voltage when tested in accordance with IEEE 112.

17. Lift Station Pump Motors Special Requirements:

- a. Watertight Integrity: Static seals at watertight mating surfaces shall be of the "O" ring type. Use of auxiliary sealing compounds shall not be required. The power and control cables shall enter the motor through a terminal housing. The pump and electrical cables shall be capable of continuous submergence without loss of waterproof integrity. The watertight integrity of the motor housing and shaft seal shall be tested during manufacture by pressurizing the motor cavity and submerging in water with motor operating.
- b. Motor Protection: The motor shall be equipped with internal thermal and moisture switches. Three separate thermostatic switches (minimum) shall be embedded into the stator windings (one per phase). Each switch shall open independently and terminate motor operation if temperature of the protected winding reaches the high temperature setpoint. A mechanically activated, moisture-sensing, micro switch shall be installed in the motor housing. The switch shall be capable of detecting airborne moisture and terminate operation of motor before liquid enters the cavity. Use of probes or floats that rely on the presence of liquid to initiate signal are not acceptable.
- c. Starts per hour: Motor shall be capable of 10 starts per hour.

C. Performance Schedule: Three Phase - Energy efficient, TEFC.

HP Factor	RPM (Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor
1-1/2	3600	143T	82	85
2	3600	145T	82	87
3	3600	145T	84	85
5	3600	182T	85	86
7-1/2	3600	184T	86	88
10	3600	213T	87	86
15	3600	215T	89	89
20	3600	254T	90	89
25	3600	256T	90	92
30	3600	284T	91	91
40	3600	286T	92	92
50	3600	324T	93	89
60	3600	326T	93	91
75	3600	364T	93	88
100	3600	365T	92	88
1	1800	143T	82	84
1-1/2	1800	145T	84	85
2	1800	145T	84	85
3	1800	182T	86	86
5	1800	184T	87	87
7-1/2	1800	213T	88	86
10	1800	215T	89	85
15	1800	256T	91	85
20	1800	256T	91	86
25	1800	284T	91	85
30	1800	286T	92	88
40	1800	324T	92	83
50	1800	326T	93	85
60	1800	364T	93	88
75	1800	365T	93	88
100	1800	404T	93	83

For motors larger than 100 hp, provide manufacturer's standard high-efficiency motor.

### PART 3 EXECUTION

#### 3.1 ERECTION/INSTALLATION/APPLICATION

- A. Install motors in accordance with manufacturer's instructions.
- B. Motors shall be aligned with the respective driven equipment as specified in related sections.

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- C. External metal frames of motors and their respective driven equipment shall be connected to ground.

END OF SECTION

SECTION 15250  
INSULATION

**PART I      GENERAL**

**1.1          SECTION INCLUDES**

- A.      Pipe and Equipment Insulation.

**1.2          RELATED SECTIONS**

- A.      Section 01000 - General Requirements.  
B.      Section 01011 - Submittals Listing.  
C.      Section 15060 - Pipe, Fittings, Valves, and  
         Accessories.  
D.      Section 15090 - Piping Supports and Anchors.  
E.      Section 16855 - Heating Cables.

**1.3          REFERENCE DRAWINGS**

- A.      See Section 01012 for the Schedule of Drawings.

**1.4          REFERENCES, CODES AND STANDARDS**

- A.      American Society for Testing and Materials (ASTM):  
1.      ASTM B209-95              Standard Specification for  
         Aluminum and Aluminum-Alloy  
         Sheet and Plate.  
2.      ASTM C552-91              Standard Specification for  
         Cellular Glass Thermal  
         Insulation.

**1.5          SUBMITTALS**

- A.      Submittals shall be in accordance with Section 01011.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

### **A. Insulation Materials**

1. Insulation materials shall be identified, inspected, controlled, and protected in a manner that will assure conformance with the referenced codes and standards.
2. Care shall be taken in the storage and handling of ~~all insulation material so that contamination by~~ grease, moisture, or other foreign matter does not occur. Insulation materials shall be stored off the ground, protected from the weather, and handled so that physical damage to the insulation material does not occur.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Cellular glass: Board and molded (rigid), inorganic, maximum 'k' value of 0.345 Btu-inch/hour per square foot per degree F at 75 degrees F, conforming to ASTM C552.
- B. Jacketing Aboveground: Aluminum, Alloy 3003, H14 temper, 0.020 inches thick, embossed, conforming to ASTM B209.
- C. Jacketing - Underground Heat Trace Applications: Wrapping consisting of polymer modified bituminous compound with a 4-mil, high-density, cross laminate, polyethylene top film and release paper backing, total thickness of 40 mils.
- D. Elbow insulation covers: Aluminum, Alloy 1100, H14 temper.
- E. Bedding Compound: Non-volatile, .008 perm inch; service temperature range of -60 degrees F to 180 degrees F; application temperature 40 degrees F to 100 degrees F.



## 2.2 ACCESSORIES

- A. Insulation Bands:
  - 1. Piping: 1/2-inch wide by 0.015-inch thick, 304 stainless steel bands.
  - 2. Equipment: 3/4-inch wide by 0.015-inch thick, 304 stainless steel bands.
- B. Screws: Number 8, by 1/2-inch, sheet metal type 302 or 304 stainless steel.

## PART 3 EXECUTION

### 3.1 FIELD CONDITION

- A. Ensure site is ready to receive work before start of construction.

### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Piping, which includes valves, fittings, and flanges, shall be insulated and jacketed when the suffix "ET" appears in the pipe line number as indicated on the drawings. Equipment shall be insulated when required on the drawings.
- B. Install materials in accordance with the manufacturer's instructions.
- C. Flanges shall have removable insulation and aluminum jacketing to permit servicing of take-down joints. Removable covers may be fabricated from segments of block insulation or from preformed sectional pipe covering and premolded components. A removable cover shall be of the same material as the adjoining pipe insulation.
- D. Fill joints and seams with bedding compound to form a smooth surface.
- E. Insulation shall be stopped at a sufficient distance from flanges to permit ease of bolt removal. Insulation shall be beveled at a 45-degree angle at this point.

- F. Install jacketing with screws on 3-inch centers on fittings and valves where banding is not possible.
- G. Labels indicating "asbestos-free" shall be attached to the outside of insulation jacketing, and adjacent to piping and equipment identification labels.
- H. Pipe Insulation
1. ~~Piping and heat tracing shall be tested in~~ accordance with Sections 15060 and 16855 before installing insulation.
  2. Piping shall be insulated and jacketed as follows:

Piping	Insulation Material	Minimum Thickness	Jacketing
Aboveground Piping			
1-1/2" and smaller	Cellular Glass	1-1/2"	Aluminum
2" through 4"	Cellular Glass	1-1/2"	Aluminum
6" through 8"	Cellular Glass	2"	Aluminum
10" and over	Cellular Glass	2-1/2"	Aluminum
Below Grade Piping	Cellular Glass	1-1/2"	Polymer Modified Bituminous Compound

3. Insulation shall be applied in a single layer with joints tightly butted, and shall be secured in place with bands on 12-inch centers.
4. Aluminum jacketing shall be applied directly over insulation (except below grade applications). Minimum lap for longitudinal joints shall be 1 inch, and minimum lap for circumferential joints shall be 2 inches. The jacketing shall be secured in place with bands on 9-inch centers.
5. Premolded elbow insulation and aluminum elbow covers shall be installed at elbows. Aluminum jacketing shall be used for all other fittings, valves, flanges, etc.
6. Lap seams against weather.

7. Finish insulation at supports, protrusions, and interruptions. At pipe supports, remove only enough insulation to provide a snug fit.
8. Inserts shall be of the same thickness, material, and contour as adjoining piping insulation. For intersection at tees or other equipment, use block or curved segments. Miter cut to fit neatly on the surface, with joints tightly butted.
9. Seal jacketing below ground per manufacturer's recommendation.
10. Insulated valves and piping systems shall be labeled in accordance with Section 15060.

I. Equipment Insulation

1. Apply insulation board directly to equipment surfaces with joints staggered and tightly butted. Secure insulation in place with stainless steel bands on 18-inch centers.
2. Board insulation shall be cemented to irregular surfaces and voids shall be filled with bedding compound.
3. Apply aluminum jacketing over insulation with 3-inch minimum lap on longitudinal and circumferential joints; secure in place with bands on 12-inch centers.
4. Equipment shall be insulated as follows:

Insulation Material	Minimum Thickness
Cellular Glass	2-1/2"

5. Insulation shall be cut away from equipment identification nameplates and beveled at a 45-degree angle.
6. Equipment and heat tracing shall be tested before installing insulation.

**END OF SECTION**

U.S DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Subcontract No. FSC607

WASTE UNITS REMEDIATION PROJECT  
SOUTHERN WASTE UNITS  
TECHNICAL SPECIFICATIONS

Division 16

PARSONS

Prepared by:

*Thomas P. Feild*

*6/12/97*

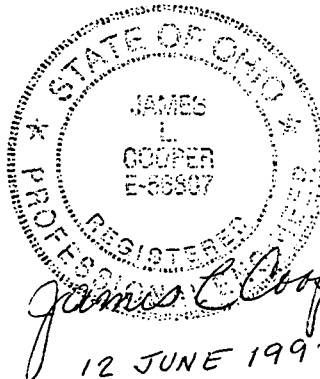
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Checked by:

*James L Cooper*

*12 JUNE 1997*

Date



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SECTION 16050  
BASIC ELECTRICAL MATERIALS AND METHODS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Combination magnetic motor starters.
- B. Selector switches.
- C. Receptacles.
- D. Conduit.
- E. Wire and cable.
- F. Instrument cable.
- G. Nameplates.
- H. Wire markers and cable tags.
- I. Wireway and auxiliary gutters.
- J. Splicing and termination components.
- K. Boxes.
- L. Cabinets.
- M. Supporting Devices.
- N. Underground Warning Tape.
- O. Electrical Testing, General.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.

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C. Section 02200 - Non Impacted Material Earthwork.

D. Section 15160 - Lift Station Pumps.

E. Section 15170 - Motors.

F. Section 16118 - Underground Ductbanks.

G. Section 16170 - Grounding and Bonding.

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H. Section 16370 - Overhead Power Distribution.

I. Section 16462 - Dry Type Transformers/Panelboards.

J. Section 16500 - Lighting.

K. Section 16855 - Heating Cables.

### 1.3 REFERENCE DRAWINGS

A. See Section 01012 for the Schedule of Drawings.

### 1.4 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.1-90 Rigid Steel Conduit-Zinc Coated.

B. InterNational Electrical Testing Association (NETA):

1. NETA ATS-95 Acceptance Testing Specification for Electrical Power Distribution Equipment.

C. National Fire Protection Association (NFPA):

1. NFPA 70 National Electrical Code, 1996 Edition.

D. National Electrical Manufacturers Association (NEMA):

1. NEMA AB 1-93 Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA ICS 1-93 Industrial Control and Systems General Requirements.
3. NEMA ICS 2-93 Industrial Control and System Controllers, Contractors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 4-93 Industrial Control and Systems Terminal Blocks.
5. NEMA ICS 6-93 Industrial Control and Systems Enclosures.
6. NEMA OS 1-89 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
7. NEMA WD 1-83 General Requirements for Wiring Devices.
8. NEMA WD 6-88 Wiring Devices - Dimensional Requirements.
9. NEMA 250-91 Enclosures for Electrical Equipment (1,000 Volts Maximum).

E. Underwriters Laboratories Inc. (UL):

1. UL 360-96 UL Standard for Safety Liquid-Tight Flexible Steel Conduit.
2. UL 486A-91 UL Standard for Safety Wire Connectors and Soldering Lugs for Use with Copper Conductors.
3. UL 510-94 UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
4. UL 854-96 Service-Entrance Cables.
5. UL 870-95 UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings.
6. Electrical Construction Materials Directory - 95.

## 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01010.

## 1.6 QUALITY ASSURANCE PROGRAM

- A. Work shall comply with NFPA 70. Use of conduit for ~~equipment ground is prohibited.~~
- B. Products shall be listed in the UL Electrical Construction Materials Directory, for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

- A. Combination Magnetic Motor Starters
  - 1. Combination Magnetic Motor Starters: NEMA ICS 1, NEMA ICS 2, AC general purpose Class A magnetic starter for induction motors for the rated horsepower combined with a magnetic circuit breaker, NEMA AB 1, with instantaneous magnetic trip in each pole. Starter, circuit breaker, and control power transformer shall be in a common enclosure. Terminals, minimum 75 degrees C rated.
  - 2. Provide externally operable handle interlocked to prevent opening of cover with circuit breaker in the ON position. Allow handle to be lockable in the OFF position.
  - 3. Contactor Coil Operating Voltage: 120 V, 60 Hz.
  - 4. Overload Relay: NEMA ICS 2, bimetal.
  - 5. Control Power Transformer: 120 V secondary, 50 VA minimum. Provide fused primary and secondary of transformer, and ground unfused leg of secondary to enclosure.
  - 6. Enclosure: NEMA ICS 6, Type 3R or 4, outdoor; or Type 12, indoor.
  - 7. Heater elements shall be included, as required, for the described service conditions.



8. Two auxiliary contacts (electrically dry), one each, normally closed and normally open, in addition to the hold-in contact, shall be provided.

B. Selector Switches

1. Enclosure, NEMA ICS 6, Type 3R or 4.
2. Two-position, maintained contact (start/stop), as indicated.
3. Three-position, maintained contact (hand/off/auto or local/off/remote), as indicated.

C. Receptacles

1. Convenience Receptacle: 125 V, 15/20 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-20. 125 V, 30 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-30. Furnish with weatherproof "while in use" covers for outdoors, wet or industrial locations.
2. Convenience receptacles in potentially wet environments, in addition to those required by NFPA 70, shall be GFCI type for personnel protection with covers to protect the receptacle from water during usage.

D. Cabinets

1. Boxes: Galvanized steel with removable endwalls.
2. Box Size: As indicated in Section 13401.
3. Fronts: Steel, surface type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
4. Knockouts: Provide as required for conduits indicated plus 25 percent spare.
5. Provide metal barriers to form separate compartments wiring of different systems and voltages.
6. Provide accessory feet for free-standing equipment.

7. Terminal Blocks: NEMA ICS 4.
    - a. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
    - b. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, ~~rated 300 volts.~~
  8. Provide ground bus and ground terminal block, each connector bonded to enclosure.
  9. Provide plastic channel with hinged or snap-on covers for internal wiring raceway.
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## 2.2 MATERIALS

### A. Conduit

1. Rigid steel, heavy wall, galvanized conduit conforming to ANSI C80.1. Rigid steel intermediate metal conduit (IMC) shall be acceptable for interior spaces. Conduit shall be 1/2 inch diameter minimum.
2. Liquid-tight flexible metal conduit conforming to UL 360. Conduit shall be 1/2 inch diameter minimum, 5 feet in length (maximum) unless indicated on drawings.
3. Conduit connections shall be threaded.

B. Wire and Cable

1. Single conductor, 600 volt insulated copper conductor. Conductors for power and lighting branch circuits shall not be smaller than No. 12 AWG. Conductors No. 12 AWG and No. 10 AWG shall be solid. Conductors No. 8 AWG and larger shall be stranded. Conductors for control shall not be smaller than No. 14 AWG stranded. Conductors for Class 1 remote-control and signal circuits shall be enclosed in cable and shall comply with NFPA 70. Power and lighting conductor insulation shall be Type THW, XHHW, or THWN. Conductors required to be rated 90 degrees C in accordance with NFPA 70 shall be insulation Type XHHW-2 or THW-2. Direct burial cable shall be type USE, conforming to UL 854.

C. Instrument Cable

1. Instrumentation cable shall be No. 16 AWG stranded tinned copper conductors. Conductors shall be polyethylene insulated and rated 600 volts, 60 degrees C. Conductors shall be twisted with aluminum-polymer shield; No. 18 AWG stranded, tinned copper drain wire. Cable shall have overall-chrome gray FR-PVC jacket.

D. Nameplates

1. Nameplates shall be engraved, three-layer laminated plastic, 5/16-inch bold style, black letters on white background.

E. Wire Markers and Cable Tags

1. Wire markers shall be single-conductor slip on, heat-shrinkable sleeve with typed or printed black letters on a white background. Wire markers shall be W. H. Brady Co. computer-printable "Bradysleeve" or approved equal.
2. Cable tags shall be rectangular, flat, non-heat shrinkable tags with 1/8-inch-high letters. Cable markers shall be Raychem-type TMS or approved equal.

F. Wireway and Auxiliary Gutters

1. Wireway and Auxiliary Gutters: General purpose, NEMA ICS 6, Type 3R enclosure with knockouts on bottom.
2. Size: As required.
3. Cover: Screw cover with full gasketing.
4. Fittings: UL 870, lay-in type with removable top, bottom, and side; captive screws.
5. ~~Material: Carbon steel.~~
6. Finish: Rust-inhibiting primer coating with gray enamel finish.

G. Splicing and Termination Components

1. Wire connectors, UL 486A, as applicable.
2. Insulation tape, UL 510.
3. Provide solderless terminal lugs, rated 75 degrees C minimum, on stranded conductors.

H. Boxes and Cover Plates

1. Junction and Pull Boxes
  - a. Junction and pull boxes shall be sized as indicated in accordance with NFPA 70, Article 370.
  - b. Junction and pull boxes located indoors shall be code-gauge, galvanized sheet steel and shall be of welded construction with conduit knockouts or raceway openings and hinged or screwed covers as indicated. Type 3R, according to NEMA 250.
  - c. Junction and pull boxes located outdoors shall have screwed, gasketed covers, and watertight hubs. Type 3R, according to NEMA 250.
2. Device and Outlet Boxes
  - a. Device and outlet boxes shall be pressed steel, zinc, or cadmium coated in accordance with NEMA OS 1 unless otherwise indicated.
  - b. Outlet boxes shall not be smaller than 4 inches octagonal by 1-1/2 inches deep and shall be provided with the proper size knockouts for the conduits intended. Unused knockouts shall remain closed or shall be sealed with knockout closures.

- c. Device or outlet boxes shall be of unit construction of a size required for the number of switches or outlets called for on the project design drawings. No sectional device boxes shall be permitted.
- d. Surface-mounted outlet boxes for receptacles, switches, or similar devices shall be cast type.

I. Supporting Devices

- 1. Support Channel shall be galvanized or painted steel.
- 2. Support hardware and accessories shall be corrosion resistant.
- 3. Supports shall be of all-welded construction.

J. Underground Warning Tape

- 1. 4-inch-wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines.

**PART 3 EXECUTION**

**3.1 SITE CONDITIONS**

- A. Ensure site is ready to receive work before start of construction.

**3.2 ERECTION/INSTALLATION/APPLICATION**

A. Conduit

- 1. Route conduit parallel or at right angles to building lines. Provide conduit supports at approximately 8-foot intervals. Route conduit so as not to create a hazard for tripping or to compromise head clearance. Minimum height above floor shall be 7 feet, 6 inches.

2. Cut conduit square using saw or pipecutter. Cut ends of conduit shall be reamed smooth.
3. Install no more than the equivalent of three 90 degree bends between junction boxes. Use hydraulic one-shot conduit bender or factory elbows for conduit diameter larger than 1-1/2 inch.
- ~~4. Use Form 8 conduit bodies to make sharp changes in direction. Avoid moisture traps, provide junction box with weep hole.~~
5. Provide cast metal boxes such as FS or FD in damp or wet locations.
6. Provide 1/8-inch nylon pull cord in empty conduits. Cap empty conduits to prevent entry of moisture and foreign objects.
7. Final conduit connections to motors or other vibrating equipment shall be made with approximately 3-foot liquid-tight flexible metal conduit.
8. Conduit and supports are to be field routed. They are not indicated explicitly on drawings.

B. Wire and Cable

1. Swab conduit before installing cable. Remove burrs, dirt, or other debris. For existing conduit, pull a mandrel through before pulling cable to verify roundness and bending radii.
2. When pulling cable into conduit, use wire pulling compound.
3. Splices shall be made only in outlet or junction boxes.
4. Provide equipment grounding conductor along with phase conductors in conduits.
5. Multiconductor cables shall contain an integral ground conductor.
6. Grounding conductors shall be connected to equipment with compression lugs. Grounding connections shall be made to clean, dry surfaces. Scale, rust, grease, and dirt shall be removed from surfaces to which grounding connections are to be made.

7. Conductors shall be color coded. Conductors No. 6 AWG and larger shall be identified using colored tape at terminals and splice points. Conductors No. 8 AWG and smaller shall be identified using colored insulation or jacket. Color coding shall be as follows:

480Y/277V Phase A	Yellow
Phase B	Orange
Phase C	Brown
Neutral (grounded)	Gray
Ground	Green
208Y/120V Phase A	Black
Phase B	Red
Phase C	Blue
Neutral (grounded)	White
Ground	Green
Plant Fire	Red and Yellow
Alarm System	Brown and Yellow

8. Install cables buried directly in earth in the following manner:
- Excavate cable trenches according to Section 02225. Provide a minimum cable cover of 24 inches below finished grade for power conductors operated at 600 volts and less. Trenches shall be not less than 8 inches wide, and shall be in straight lines between cable markers. Cable plows shall not be used. Bends in trenches shall have a radius of not less than 36 inches. Where two or more cables are laid parallel in the same trench, space cables laterally at not less than 3 inches apart.
  - When rock is encountered, remove to a depth of at least 3 inches below the cable and fill the space with sand or clean earth free from particles larger than 1/4 inch.
  - Do not unreel and pull cables into the trench from one end. Unreel cable on grade and lift into position onto bedding as indicated.
  - Provide warning tape, minimum 12 inches above top of cable.

- e. Bury cables directly in earth, except under roadways, where cables shall be installed in plastic ducts encased in concrete, as indicated. Slope ducts to drain.
- f. Use heat shrink adhesive coated caps on cable ends or tape cable ends immediately after cutting to prevent moisture from entering the cable. Varnish the tape when cable is not expected to be connected for at least 72 hours.
- g. Separate cables crossing other cables or metal piping from each other by not less than 12 inches of well tamped earth.
- h. Provide cables in one piece without splices between connections except where the distance exceeds the lengths in which cables are manufactured.
- i. Bends in cables shall have an inner radius not less than 12 times the cable diameter.
- j. Leave a horizontal slack of approximately 3 feet in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections.



- k. Provide an identification slab at each change of direction of cable, over the ends of ducts or conduits which are installed under paved areas and roadways, and over each splice. Identification slabs shall be of concrete approximately 20 inches square by 6 inches thick and shall be set flat in the ground so that top surface projects not less than 3/4 inch, nor more than 1 1/4 inches aboveground. The concrete shall have a compressive strength of not less than 3000 psi and have a smooth troweled finish on exposed surface. Inscribe an identifying legend such as "electric cable" on the top surface before concrete hardens. Inscribe circuit numbers as indicated on drawings on slabs as directed. Letters or figures shall be approximately 2 inches high and grooves shall be approximately 1/4 inch in width and depth. Install slabs so that the side nearest the inscription on top shall include an arrow indicating the side nearest the cable.

C. Nameplates

1. Clean surfaces prior to installing nameplates.
2. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using self-tapping screws.

D. Wire and Cable Markers

1. Provide wire markers on each conductor in pull boxes and junction boxes and at each load connection. Provide cable tags in pull boxes for multiconductor cables.
2. Wire and cable tags shall identify panel and circuit number or control wire number, as required.

E. Disconnect Switches

1. Mounting supports shall not be fastened to or penetrate wall panels.

F. Receptacles

1. Install convenience receptacles 48 inches above finished floor. Receptacle mounting supports shall not be fastened to or penetrate wall panels.
2. Label receptacles with panelboard and circuit number from which they are served.

G. Combination Magnetic Motor Starters

1. Install motor controllers where indicated on drawings.
2. Install motor controller with center line of disconnect operator 54 inches above finished floor.
3. Install overload heater element in motor controller to match motor characteristics.
4. Provide engraved nameplate identifying motor served.

H. Selector Switches

1. Mount selector switches at a mounting height of 54 inches above the floor adjacent to the equipment controlled. Provide slotted channel mounting supports where building column or wall is not suitable for support.

I. Clearances

1. Clearances from points of access to electrical equipment and other devices shall conform to the requirements of NFPA 70.
2. Equipment control devices and other electrical equipment requiring operation or maintenance shall have a minimum working clearance of 3 feet from the surface of operation or access, unless greater clearance is required by NFPA 70.

J. Boxes

1. Coordination of Box Locations
  - a. Provide electrical boxes as indicated and as required for splices, taps, wire pulling, and equipment connections.
  - b. Electrical box locations indicated are approximate unless dimensioned.
  - c. Locate and install boxes to allow access.

- d. Do not install boxes back to back in walls. Provide 6-inches (minimum) separation in non-acoustic rated walls and 24 inches (minimum) separation in acoustic rated walls.
- e. Coordinate mounting heights of boxes and locations of outlets mounted above counters, benches, and backsplashes to ensure locations are useful.
- f. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

## 2. Outlet Box Installation

- a. Firmly secure in place outlet or utility boxes concealed in the construction. Set outlet or utility boxes true, square, and flush with the finish surfaces for the application of the appropriate cover plate.
- b. Provide knockout closures for unused knockout openings.
- c. Support boxes independently of conduit except for cast boxes when connected to two rigid metal conduits, both supported within 12 inches of the box to be supported.
- d. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

## 3. Pull and Junction Box Installation

- a. Support pull and junction boxes independently of conduit.

## K. Cabinets

- 1. Install cabinet fronts plumb.

## L. Supporting Devices

- 1. Installation of structural steel framing, concrete pads, etc., shall be complete before installing supporting devices.
- 2. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structures in accordance with manufacturer's recommendations as indicated.
- 3. Use expansion anchors for support on concrete surfaces.

4. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
5. Do not drill structural steel members for installing support devices.
6. Fabricate supports from structural steel or steel channel. Rigidly bolt to structural steel to present a neat appearance. Use hexagon head bolts with spring lock washers under nuts.
7. Install freestanding electrical equipment on concrete pads.
8. Install surface mounted cabinets and enclosures with four anchors (minimum). Provide steel channel supports to stand cabinets and enclosures 1 inch from the wall.

### 3.3 QUALITY CONTROL

#### A. Electrical Inspection and Testing - General

1. Electrical inspection and testing for work in this section and in other electrical sections shall conform to the following requirements and to NETA ATS. Tests required by NETA ATS for electrical work on this project shall be performed unless specific instruction is provided otherwise. Any additional requirements or exceptions shall be as noted in the other electrical sections for the specific electrical work of that section only.
2. Testing shall be witnessed by FDF, CQC Consultant-Quality Control personnel (who must approve results) and manufacturer's service representative(s), if required. Notice of testing must be furnished 7 days in advance.
3. Submit test results and calibration data on approved forms.
4. Perform operational tests to demonstrate control and interlocking wiring.
5. Visual inspections shall be performed for phasing and connections. Phasing shall be A, B, C clockwise at all three phase disconnects.
6. Repair or replacement of components where test results are unacceptable, including those damaged during testing process, is required.

B. Electrical Inspection and Testing - This Section

1. Perform continuity and operation tests on power and control circuits. Low voltage thermographic survey of cable connections required by NETA ATS are not required. Wire insulation for conductors No. 6 AWG and larger shall be megger tested between each conductor and ground. A 1000-volt megger shall be used for insulation rated 600 volts. Minimum resistance shall be 100 megohms.
2. Insulation resistance tests shall not be performed on solid state equipment unless authorized by its manufacturer and in strict accordance with the manufacturer's recommendations. Solid state equipment includes static ground fault devices, such as ground fault circuit interrupters.
3. Confirm that electrical connections to utilization equipment have been made in accordance with manufacturer's instructions.
4. Perform motor tests according to NETA ATS.
5. Motor windings shall be checked for continuity.
6. Motor windings rated 460 volts nominal shall be megger tested with a 1,000-volt megger prior to connection of power leads. Minimum acceptable resistance shall be 100 megohms. Motor and phase rotation shall be checked with a phase rotation tester manufactured by G. Biddle Company (Catalog No. 56060) or equal on equipment which could be damaged by reverse rotation.
  - a. Motor and phase rotation shall be verified before energizing motors.
  - b. Motors shall be "bumped" to check for proper direction of rotation prior to performing operational tests on the equipment in the presence of FDF.

END OF SECTION

SECTION 16118  
UNDERGROUND DUCTBANKS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Underground Ductbanks.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.  
B. Section 01011 - Submittals Listing.  
C. Section 02200 - Non-Impacted Material Earthwork.  
D. Section 03001 - Concrete.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI):  
1. ANSI C80.1-90 Rigid Steel Conduit -  
Zinc-Coated.
- B. Institute of Electrical and Electronic Engineers (IEEE):  
1. IEEE C2-97 National Electrical Safety  
Code.
- C. National Fire Protection Association (NFPA):  
1. NFPA 70 National Electrical Code, 1996  
Edition.
- D. National Electrical Manufacturers Association (NEMA):  
1. NEMA TC 3-90 PVC Fittings for Use with  
Rigid PVC Conduit and Tubing.

- 2. NEMA TC 6-90 PVC and ABS Plastic Utilities  
Duct for Underground  
Installation.

- E. Underwriters Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directories,  
1995.

#### **1.5 PROJECT CONDITIONS**

- A. Accurately record actual locations of exact routing of  
ductbank by field survey.

#### **1.6 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70 and IEEE C2.
- B. Furnish products listed and classified by Underwriters  
Laboratories, Inc. as suitable for purpose specified and  
indicated.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect, and handle products to site.
- B. Protect conduit from corrosion and entrance of debris by  
storing above grade. Provide appropriate covering.

#### **1.8 PROJECT CONDITIONS**

- A. Verify routing and termination locations of ductbank  
prior to excavation for rough-in.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Plastic Utilities Duct: NEMA TC 6; PVC.
- C. Plastic Utility Duct Fittings: NEMA TC 3.

## 2.2 ACCESSORIES

- A. Underground Warning Tape: 4-inch-wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that excavation, base material installation, and compaction are completed.

### 3.2 ERECTION/INSTALLATION/APPLICATION

#### A. Underground Duct:

1. Install power ductbank 36 inches (minimum) to top of ductbank below finished grade.
2. Install duct with minimum slope of 4 inches per 100 feet. Slope duct to manholes.
3. Cut duct square using saw or pipe cutter; de-burr cut ends.
4. Insert duct to shoulder of fittings; fasten securely.
5. Join nonmetallic duct using adhesive as recommended by manufacturer.
6. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
8. Provide suitable fittings to accommodate expansion and deflection where required.
9. Terminate duct at manhole entries using end bell.
10. Stagger duct joints vertically in concrete encasement 6 inches minimum.
11. Use suitable separators and chairs installed not greater than 4 feet on centers.
12. Band ducts together before placing concrete.
13. Securely anchor duct to prevent movement during concrete placement.
14. Place concrete under provisions of Section 03001. Use mineral pigment to color concrete red.



15. Provide minimum 3-inch concrete cover at bottom, top, and sides of ductbank.
16. Provide pull rope in each duct except sleeves and nipples. Minimum 1/2-inch, 4,000 psi tensile strength polypropylene.
17. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
18. Perform excavations and backfill trenches under provisions of Section 02200 of this specification package.
19. Interface installation of underground warning tape with backfilling. Install tape below finished surface as indicated on drawings.
20. All duct end bells shall be rigid steel.
21. Perform penetrations and sealing of duct bank with lift station manholes and junction boxes according to manufacturer's instructions.

**END OF SECTION**

SECTION 16121  
MEDIUM-VOLTAGE CABLE

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Medium-voltage cable.
- B. Cable terminations.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.
- C. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI C2-97 National Electrical Safety Code.
- B. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
- C. Institute of Electrical and Electronic Engineers, Inc. (IEEE):
  - 1. IEEE 48-96 Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminations.

- D. National Electrical Manufacturers Association (NEMA):  
1. NEMA WC 8-88 Ethylene-Propylene-Rubber-  
Insulated Wire and Cable for the  
Transmission and Distribution of  
Electrical Energy.

- E. Underwriters Laboratories, Inc. (UL), Electrical  
Construction Materials Directories, 1995.

- 
- F. National Electrical Testing Association (NETA):  
1. NETA ATS-95 Acceptance Testing Specification  
for Electrical Power Distribution  
Equipment.

#### **1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.

#### **1.6 QUALITY ASSURANCE PROGRAM**

- A. See Section 01000.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept cable and accessories on site in manufacturer's  
packaging. Inspect for damage.
- B. Store and protect in accordance with manufacturer's  
instructions.
- C. Protect from weather. Provide adequate ventilation to  
prevent condensation.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Medium-Voltage Cable
1. Okonite.
  2. Houston Wire & Cable.
  3. Kerite.
  4. Rome.

B. Cable Terminations and Cable Splices

1. 3M.
2. Raychem.
3. RTE.

2.2 MATERIALS

A. Medium-Voltage Cable

1. Description: NEMA WC 8; ethylene propylene rubber insulated cable.
2. Voltage: 15 kV, ungrounded.
3. Conductor: Copper, concentric, stranded with foil conductor shield.
4. Construction: Single conductor with metal tape insulation shielding.
5. Insulation Level: 133 percent.
6. Insulation Jacket: PVC, 80 mils minimum thickness.

B. Cable Terminations and Cable Splices

1. Description: IEEE 48; Class 1, cable termination in kit form with stress cone, shield ground connection, and accessories and molds required for proper application.

C. Tape Termination and Splices

1. Description: IEEE 48; Class 1, tape termination kit with semi-conductive tape, stress control tape, splicing tape, vinyl plastic tape, stress cone, mechanical ground straps, and cable preparation kit.

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Verify existing conditions prior to beginning installation. Notify FDF if conditions affect the work specified or indicated on drawings.

3.2 PREPARATION

- A. Use swab to clean ducts before pulling cables.
- B. Run mandrel through duct to confirm absence of pinch points or obstructions.

### 3.3 ERECTION/INSTALLATION/APPLICATION

- A. Conform to requirements of NFPA 70 and ANSI C2.
- B. Install cable and accessories in accordance with manufacturer's instructions.
- C. Avoid abrasion and other damage to cables during installation.
- D. Use suitable lubricants and pulling equipment.
- E. Do not exceed manufacturer's recommended maximum cable pulling tensions and minimum bending radius.
- F. Ground cable shield at each termination and splice.
- G. Label each cable on both ends with phase A, B, or C as determined by testing required herein.

### 3.4 QUALITY CONTROL

- A. Furnish products listed and classified by UL as suitable for purpose specified and shown.
- B. Inspect exposed cable sections for physical damage.
- C. Inspect cable for proper connections as shown on the contract drawings.
- D. Inspect shield grounding, cable supports, and terminations for proper installation.
- E. Perform DC high potential test of each conductor in accordance with NEMA WC 8 and/or NETA ATS. Ground other conductors in the circuit during the test. Perform test on existing cable after installation. Perform test on new 15kV cable before making tap onto existing cable.

- F. Apply test voltage in at least 10 equal incremental increases to maximum test voltage.

	Maximum Voltage	10 Increments of:
New Cables 15 kV	65 kV	6.5 kV
Existing Cables 13.2 kV	49 kV	4.9 kV

- G. Record leakage current at each increment, allowing for charging current decay.
- H. Hold maximum test voltage for 10 minutes.
- I. Test Reports: Record results of cable test in tabular form, in plots of current versus voltage for incremental voltage steps, and current versus time at 30-second intervals at maximum voltage. Submit for approval.
- J. Prior to connection to pole mounted bare conductors, test phase rotation of cables to assure that phase A, B, and C are aligned as indicated.
- K. Inspection and testing shall be by Subcontractor and may be observed by FDF.

END OF SECTION

SECTION 16170  
GROUNDING AND BONDING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.
- D. Fence grounding.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.
- C. Section 15170 - Motors.
- D. Section 16050 - Basic Electrical Materials and Methods.
- E. Section 16370 - Overhead Power Distribution.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. InterNational Electrical Testing Association (NETA):
  - 1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.

- C. Underwriters Laboratories, Inc. (UL):
1. UL 467-93 UL Standard for Safety Grounding and Bonding Equipment.
  2. Electrical Construction Materials Directory-95.

## 1.5 SYSTEM DESCRIPTION

- A. Rod electrode and grounding connections.
- B. Grounding System Resistance: 5 ohms maximum.

## 1.6 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Provide certification of ground testing instrumentation.
- C. Provide record of as-built locations of grounding electrodes, if grounding electrodes are required.

## 1.7 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed in the UL Electrical Construction Materials Directory as suitable for the purpose specified and indicated.
- C. Provide certification of ground testing instrumentation according to NETA ATS.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers
1. Mechanical Connectors
    - a. Burndy.
    - b. Ideal.
    - c. Ilsco.



2. Exothermic Connections
  - a. Cadweld.
  - b. Thermoweld.

## 2.2 MATERIALS

- A. Rod Electrode
  1. Copper-clad steel, 3/4-inch diameter, 10-foot length.
- B. Mechanical Connectors
  1. Bronze.
- C. Wire
  1. Stranded copper.
    - a. Grounding Conductor: Size to meet NFPA 70 requirements.
- D. Grounding and bonding materials shall conform to UL 467.

## PART 3 EXECUTION

### 3.1 SITE CONDITIONS

- A. Verify that final backfill and compaction have been completed before driving rod electrodes.
- B. Verify that underground utilities will not interfere with the proposed rod locations prior to driving rod electrodes.

### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install additional rod electrodes as required to achieve specified resistance to ground.

- C. Equipment Grounding Conductor: Provide separate, insulated conductor with each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Connect ground conductors to reinforcing bars in foundation before pouring concrete. Tie to structural steel members when they are installed, by exothermic connection.
- 
- E. Ground metal equipment enclosures by attachment to ground rod system, the building steel, or existing periphery grounding system.
- F. Ground pole-mounted equipment and static line conductors as indicated on the drawings.
- G. Drive ground rods until the top is 12 inches below grade.
- H. Fence Grounding: Fences shall be grounded with a ground rod at each fixed gate post and at each corner post:
1. Drive ground rods as indicated.
  2. Attach a No. 4 AWG copper conductor, by fusion weld process, to the ground rods and extend it underground to the immediate vicinity of the fence post.
  3. Lace the conductor vertically into 12 inches of fence mesh and fasten it by two approved bronze compression fittings, one to bond the wire to the post and the other to bond the wire to the fence. Each gate section shall be bonded to its gatepost by a 1/8-inch by 1-inch flexible braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

### 3.3 QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation as defined by contract documents and manufacturer's instructions. Accurately record as-built locations of grounding electrodes if required, and submit to FDF. Test instrumentation shall conform to NETA ATS. Provide certification for instrumentation.
- B. Measure the system's resistance to the ground; perform testing in accordance with instrument manufacturer's recommendations using the fall-of-potential method. Measure resistance at each pole and at each 480 V service as a minimum. Provide written test reports indicating overall resistance to ground and resistance of each electrode to ground.

END OF SECTION

SECTION 16311  
PRIMARY SWITCHGEAR

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Provision, installation, and testing of outdoor primary switchgear containing:
  - 1. 15 kV fused disconnect switch.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 16118 - Underground Ductbanks.
- C. Section 16121 - Medium-Voltage Cable.
- D. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI C37.20.3-87 Metal-Enclosed Interrupter  
(Rev. 1992) Switchgear.
- B. Institute of Electrical and Electronics Engineers (IEEE):
  - 1. IEEE C62.1-89 Standard for Gapped Silicon-Carbide Surge Arresters for AC Power Circuits.
  - 2. IEEE 48-96 Standard Test Procedures and Requirements for High-Voltage AC Cable Terminations.

- C. InterNational Electrical Testing Association (NETA):  
1. NETA ATS-95 Acceptance Testing  
Specification for Electrical  
Power Distribution Equipment.
- D. National Fire Protection Association (NFPA):  
1. NFPA 70 National Electrical Code, 1996  
Edition.

## 1.5 SYSTEM DESCRIPTION

- A. Three phase, 60 Hz outdoor primary metal enclosed switch shall be provided, installed, and tested as indicated on drawings. Switch shall be an addition to primary switchgear on the medium voltage side of unit substation N18-1, supplied by Siemens - ITE. Nameplate information follows:

1. Switchboard Type  
Series: HV  
S.O.: 1716472-1  
System: 13.2 kV, 3 phase, 3 wire, delta,  
600 A Bus

The switch enclosure shall be equipped with a cable exit "top hat" compartment, dimensions as indicated and with an oversized cable compartment 18 inches deeper than that of the original switchgear. Switch shall be furnished with a connection kit of minimum 600 A capacity for bus connection to original switch as indicated. Switch shall be configured for future reversal of power flow by reversing line and load connections from those indicated. (i.e., in the future, the overhead line will be connected to the line or source side of the switch and the connection to N18-1 will become the load side of the switch.)

- B. Final field testing shall be provided upon completion of the primary switchgear installation. Testing will be performed by a testing firm as a subcontractor to the installation subcontractor. The testing firm shall be certified according to NETA ATS.

## 1.6 SUBMITTALS

- A. Provide submittals as required by Section 01011.

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- B. Provide product data for equipment and materials specified. Include catalog sheets and drawings showing voltage, ratings, impedances, normal and short-circuit current ratings, dimensions, enclosure, and other relevant details.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section, with minimum 5 years documented experience.
- B. Conform to requirements of NFPA 70.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect switchgear from moisture and debris. Provide auxiliary heating in switchgear.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Siemens Energy & Automation, Inc. only for compatibility and bus connection to existing installed equipment (substation N18-1). Local representative is Nick Soldano, 4770 Duke Drive, Suite 381, Mason, OH 45040 (513-398-9288).

#### 2.2 PRODUCTS/EQUIPMENT

- A. Primary Switchgear
  - 1. Description: fused air interrupter load break switch, conforming to ANSI C37.20.3. Switch shall be compatible for bus connection as indicated to primary switch of existing substation noted in 1.5.
  - 2. Construction: Outdoor.
  - 3. Finish: Manufacturer's standard acrylic enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
  - 4. Main Buses: Copper.

5. Incoming cable terminals: For incoming circuits, 15 kV, 133 percent insulation, shielded, copper 1/c 350 kcmil cables per phase. Provide insulated or grounded, physical isolation for cable terminals from load and line side of switch.
6. Voltage: 13.2 kV, three phase, 60 Hz.
7. Maximum Design Voltage: 15 kV.
8. Basic Impulse Level: 95 kV.
9. ~~Continuous and short-circuit current ratings: As~~ furnished with substation N18-1.
10. Furnish 6 fuses for switches.
11. Provide spring-charged stored energy mechanism, manually charged.
12. Enclosure: Weatherproof for outdoor use, ventilated and gasketed with padlocking features.
13. Surge Arresters: IEEE C62.1, distribution class for ungrounded system, factory connected to incoming cable terminals.

### 2.3 ACCESSORIES

- A. Incoming Cable Terminations: Conform to IEEE 48.
- B. Nameplates: White with black lettering, fastened with screws.
- C. Space Heaters: 120 volt, sized by Manufacturer; compatible with heaters provided for existing substation N18-1.

### 2.4 SOURCE QUALITY CONTROL

- A. Testing: Perform factory acceptance tests for each section of the switchgear as required by relevant national standards cited in Article 2.2. Tests may be witnessed by FDF.

**PART 3 EXECUTION****3.1 EXAMINATION**

- A. Coordinate construction of foundation anchors and embedments with the specific requirements of the equipment.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install line and ground connecting conductors associated with surge arresters according to NFPA 70 and manufacturer's instructions.
- C. Provide new engraved plastic nameplates, white lamicaid with black core mounted on outside of each cubicle, identifying equipment served, as indicated on the single-line diagrams. Letters shall be 5/16 inch high.
- D. Connect space heater in switch to power source in existing substation N18-1. Wire according to manufacturer's instructions.

**3.3 FIELD QUALITY ASSURANCE**

- A. Perform operational and final acceptance testing on switchgear to verify operation and field wiring connections after installation. Testing will be performed by a testing firm as a subcontractor to the installation subcontractor. Testing firm shall be certified according to NETA ATS. Testing shall conform to applicable sections of NETA ATS.

**END OF SECTION**



SECTION 16370  
OVERHEAD POWER DISTRIBUTION

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Poles.
- B. Crossarms.
- C. Pole hardware.
- D. Insulators.
- E. Line conductors.
- F. Arresters and cut-outs.
- G. Pole-mounted load interrupting disconnect switches.
- H. Fuses for cut-outs and switches.
- I. Pole-mounted distribution transformers.
- J. Anchors.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.
- C. Section 16050 - Basic Electrical Materials and Methods.
- D. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

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#### 1.4

#### REFERENCES

- A. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code, 1996 Edition.
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- B. ~~American National Standards Institute (ANSI):~~
1. ANSI C2-97 National Electrical Safety Code.
  2. ANSI C29.2-92 Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type.
  3. ANSI C29.4-89 Wet-Process Porcelain Insulators - Strain Type.
  4. ANSI C29.5-84 Wet-Process Porcelain Insulators - Low and Medium Voltage Types.
  5. ANSI C29.7-92 Porcelain Insulators - High Voltage Line-Post Type.
  6. ANSI C37.30-92 Definitions and Requirements for High-Voltage Air Switches, Insulators, and Bus Supports.
  7. ANSI C135.1-79 Galvanized Steel Bolts and Nuts for Overhead Line Construction.
  8. ANSI C135.22-88 Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction.
  9. ANSI O5.1-92 Wood Poles Specifications and Dimensions.

## C. American Society for Testing and Materials (ASTM):

1. ASTM A36/A36M-96 Standard Specification for Carbon Structural Steel.
2. ASTM A475-95 Standard Specification for Zinc-Coated Steel Wire Strand.
3. ASTM A675/A675M Rev. A-90 Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
4. ASTM B231-95 Concentric-Lay-Stranded Aluminum 1350 Conductors.
5. ASTM B232-92 Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR).
6. ASTM B2-94 Medium-Hard Drawn Copper Wire
7. ASTM D698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>).

## D. American Wood-Preservers Association (AWPA):

1. AWPA C4-89 Poles - Pressure Process.
2. AWPA C25-89 Standard for the Preservative Treatment of Crossarms by the Pressure Process.

## E. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE C62.11-93 Metal-Oxide Surge Arresters for AC Power Circuits.

F. National Electrical Manufacturers Association (NEMA):

1. NEMA LA 1-92 Surge Arresters.
  2. NEMA WC 7-88 Cross-Linked  
Thermosetting  
Polyethylene-Insulated  
Wire and Cable for the  
Transmission and  
Distribution of  
Electrical Energy.
- 

G. Underwriters Laboratories, Inc. (UL):

1. UL 96-94 UL Standard for Safety  
Lightning Protection  
Components.
2. Electrical Construction Materials Directory-95.

1.5 **SYSTEM DESCRIPTION**

- A. Poles specified herein shall be furnished by FDF for installation by Subcontractor. Existing poles to be removed shall be returned to FDF.

1.6 **QUALITY ASSURANCE PROGRAM**

- A. Installing Subcontractor: Company specializing in manufacturing products specified in this section with a minimum of 3 years experience. Experience of the past 3 years shall include 3 different medium voltage aerial pole line installations each of at least 5,000 circuit feet.
- B. Conform to requirements of NFPA 70 and ANSI C2.
- C. Furnish products, where available, listed in the UL Electrical Construction Materials Directory, as suitable for the purpose specified and indicated.
- D. Installation shall comply with ANSI C2, Heavy Loading District, Grade B Construction.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect poles from damage and decay by stacking to provide free circulation of air. Maintain 1 foot (300 mm) minimum spacing between bottom pole and ground or ground vegetation. Do not store poles above decayed or decaying wood.
- B. Stack poles stored for more than 2 weeks on decay-resistant skids arranged to support poles without noticeable pole distortion.
- C. Handle treated poles with tools which will not produce an indentation greater than 1 inch (25 mm) deep. Do not drag treated poles along ground. Do not apply tools to that section of treated poles between 1 foot (300 mm) above and 2 feet (600 mm) below ground line.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Poles
  - 1. Wood Poles: ANSI O5.1; treated southern pine poles of length and class indicated.
  - 2. Select poles for straightness, minimum sweeps, and short crooks.
  - 3. Preservative: ANSI O5.1 and AWP A C4, Pentachlorophenol.
  - 4. Apply preservative to poles as required by AWP A C4 with minimum net retention of 12 lbs/ft<sup>3</sup> (285 kg/m<sup>3</sup>). Obtain complete sapwood penetration.
- B. Crossarms
  - 1. Crossarms: Straight-grained southern pine, free of twists to within 0.1 inch per foot of length, with bends and twists in only one direction.
  - 2. Apply preservative to crossarms as required by AWP A C25 with minimum net retention of 8 lbs/cu ft (190 kg/cu m).
  - 3. Crossarm Dimensions: as indicated.

C. Pole Hardware

1. Miscellaneous Pole Hardware: Hot-dipped galvanized after fabrication.
2. Crossarm Braces: Flat structural steel zinc coated to ASTM A675, span, as indicated, formed in one piece from 1/4 by 1-1/4 inch steel.
3. Eye Bolts and Nuts: ANSI C135.1.
4. Ground Rods: Copperweld 3/4 inch O.D. by 10 foot - 0 inches long.
5. Butt Plate: Copper.
6. Pole-top Insulator Pins: ANSI C135.22.
7. Hot-line Clamps: Screw type with concealed threads. Fill thread chamber with corrosion-resistant compound.
8. Bail Clamps: Self clamping type. Fill contact grooves corrosion-resistant compound.
9. Guy Strand: High strength, seven-strand steel cable galvanized to ASTM A475, Class A or B.
10. Guy Termination: Preformed wire type.
11. Guy Guards: 8-foot (2 m) long plastic, colored yellow.
12. Ground Wire: Soft drawn solid copper conductors, 4 AWG minimum size.
13. Air Terminal: UL 96; 18-inch copper air terminal.
14. Guy Adapter: Tripleye.

D. Insulators

1. Insulators: Radio interference free wet process porcelain insulators with minimum wet flashover rating of 80 kV.
2. Line Post Insulators: ANSI C29.7; Class 57.1.
3. Suspension Insulators: ANSI C29.2; Class 52.9.
4. Pin Insulators: ANSI C29.5; Class 55.5.
5. Guy Strain Insulators: ANSI C29.4; Class 54.1.

E. Line Conductors

1. Medium-voltage Line Conductors: Bare aluminum conductor steel reinforced, size as indicated: ASTM B232. Bare aluminum conductor, size as indicated: ASTM B231. Medium drawn copper wire, size as indicated: ASTM B2.

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F. Arresters and Cutouts

1. Combination Surge Arresters/ Fuse cutouts:  
arranged for crossarm mounting. Arresters, IEEE C62.11, metal oxide, RMS rating shall be 15 kV. Fused Cutouts, ANSI C37.42, drop-out type, rated 110 kV BIL, 200 A continuous current and adequate for interrupting rating of fuses specified herein. Where indicated, arresters or cut-outs may be used and furnished individually.

G. Pole-mounted load interrupting disconnect switches

1. Pole-mounted switch shall be vertical or horizontal as indicated, three-pole gang operated, with a padlock arrangement for locking in both open and closed positions. Steel parts shall be hot-dip galvanized. Operating rods shall be isolated from the switch by an insulating link or section located as close to the switch as possible. Switch shall be designed for double crossarm mounting and for breaking a 3/4-inch coating of ice before contacts are opened or closed. Switch shall be rated 110 kV BIL and comply with ANSI C37.30 for voltage and current requirements indicated.

H. Fuses for cut-outs and pole mounted load interrupting disconnect switches.

1. Fuses: Type K, rated as indicated; minimum symmetrical interrupting rating at 13.2 kV, 10 kA for cut-outs and 12.5 kA for disconnect switches.

I. Pole-Mounted Distribution Transformers

1. ANSI C57.12.20, single phase, oil filled, self-cooled with primary bushings and secondary terminations, Basic Impulse Level of 125 kV, temperature rise of 65 degrees C above 30 degrees C ambient, ratings as indicated. Transformers shall be rated for 14.4 kV minimum in the delta primary configuration indicated. Provide standard ~~primary taps with externally-operated tap changer.~~ Taps shall be full current, two at 2-1/2 percent each above and two at 2-1/2 percent each below normal voltage. Provide standard accessories with dial type thermometer.

J. Anchors

1. Helical Screw Anchors: Galvanized steel, ASTM A36/36M.

**PART 3 EXECUTION**

**3.1 SITE CONDITIONS**

- A. Verify that field measurements are as shown on drawings.
- B. Verify that there are no underground utilities located below the poles prior to installation.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Plug unused holes in poles using treated wood dowel pins. Treat field-cut gains and field-bored holes with preservative.
- C. Shorten poles when required by cutting from top end. Apply hot preservative to shortened end of pole.



- D. Set poles in straight line. Place curved poles with curvature in line with lead pole. Maintain an even grade.
- E. Dig setting holes large enough to permit use of power tampers to full depth. Place earth in maximum 6-inch (150 mm) layers and pack to 95 percent density per ASTM D698.
- F. Rake poles located at corners, angles, and dead ends so that poles are vertical after line installation.
- G. Do not install poles along the edge of cuts and embankments or where soil may be washed out.
- H. Identify each pole using aluminum marker stamped with characters 2-1/2 inches (60 mm) high, minimum. Locate to provide maximum visibility from roadway and fasten with aluminum nails. Obtain identifying numbers from FDF.
- I. Minimum depths in normal firm ground, measured from lower side of pole:

OVERALL LENGTH	DEPTH FOR STRAIGHT LINES	DEPTH AT CURVES, CORNERS, AND POINTS OF EXTRA STRAIN
30'	5'-6"	5'-6"
35'	6'-0"	6'-0"
40'	6'-6"	6'-6"
45'	7'-0"	7'-6"
50'	7'-6"	8'-0"
55'	7'-6"	8'-0"

- J. Set crossarms at right angles to line for straight runs; and to bisect the angle of turns in line direction.

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- K. Provide two braces for each crossarm.
- L. Install conductors to ANSI C2. Maintain clearances required by ANSI C2, except as follows: phase to phase - 20 inches, phase to ground - 16 inches, above roads, 480 V conductors - 23 feet, over buildings, all conductors, 8 feet. Conductor arrangement shall be phase A, B, C from north to south and from east to west for horizontal construction.
- 
- M. Conductor taps shall be made with bail clamps and hot line connectors using compression connectors. Taps shall not be made directly on line conductors. Make aluminum connections to copper or other material using only splices, connectors, lugs, or fittings designed for that specific purpose.
- N. Install guys and anchors according to ANSI C2 requirements.
- O. Use small diameter steel probe to verify area is free of underground obstructions prior to installation of anchors.
- P. Bond metal enclosures on poles to pole ground wire in accordance with NFPA 70, ANSI C2 and manufacturer's instructions.
- Q. After initial energizing of transformers, measure the secondary voltage and adjust to nominal voltage by changing taps.

**END OF SECTION**

SECTION 16462  
DRY TYPE TRANSFORMER/PANELBOARDS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Dry type, two-winding transformers integrated with primary and secondary main breakers and feeder breakers.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.  
B. Section 01011 - Submittals Listing.  
C. Section 16050 - Basic Electrical Materials and Methods.  
D. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. InterNational Electrical Testing Association (NETA):  
1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Electrical Manufacturers Association (NEMA):  
1. NEMA AB 1-93 Molded Case Circuit Breakers and Molded Case Switches.  
2. NEMA PB 1-90 Panelboards.

- 3. NEMA PB 1.1-91 General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
  - 4. NEMA ST 20-92 Dry Type Transformers for General Applications.
  - 5. NEMA 250-91 Enclosures for Electrical Equipment (1000 Volts Maximum).
- C. National Fire Protection Association (NFPA):
- 1. NFPA 70 National Electrical Code, 1996 Edition.
- D. Underwriters Laboratories, Inc. (UL):
- 1. Electrical Construction Materials Directory-95.

#### 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Product Data: Include outline and support point dimensions of enclosures and accessories; unit weight; voltage; kVA, number of phases, impedance ratings, and characteristics; X/R ratio; tap configurations; insulation system type; rated temperature rise; and main bus ampacity, integrated short circuit ampere rating, circuit breaker, arrangement, and sizes.
- C. Transformer Test Reports:
  - 1. Factory Test: NEMA ST 20. Indicate loss data; efficiency at 25, 50, 75, and 100 percent rated loads; and sound level.
  - 2. Field Test: Indicate primary and secondary voltages as measured.

#### 1.6 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70.

- B. Furnish products listed in the UL Electrical Construction Materials Directory for the purpose specified and indicated.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver transformers/panelboards individually wrapped for protection and mounted on shipping skids.
- B. Accept transformers/panelboards on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer/panelboards' internal components, enclosure, and finish.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Siemens.
- B. Westinghouse.
- C. Square D.

### 2.2 EQUIPMENT

- A. Two-winding transformers
  - 1. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers; ratings as indicated on contract drawings.
  - 2. Insulation system and average winding temperature rise for rated kVA as follows:
    - a. 1-30 kVA: Class 185 with 115 degrees C rise.

- b. 16-500 kVA: Class 220 with 115 degrees C rise.
- 3. Case Temperature: Do not exceed 40 degrees C rise above ambient at warmest point.
- 4. Winding Taps:
  - a. Transformers: NEMA ST 20. Transformers shall have four full current taps, two at 2-1/2 percent each above and two at 2-1/2 percent each below normal voltage.
- 5. Sound Levels: NEMA ST 20, not to exceed 85 dBA at 3 feet.
- 6. Basic Impulse Level: 10 kV.
- 7. Ground core and coil assembly to enclosure by means of a visible, flexible copper grounding strap.
- 8. Mounting: Suitable for wall or floor mounting.
- 9. Coil Conductors: Continuous windings with terminations brazed or welded.
- 10. Enclosure: NEMA ST 20. Provide lifting eyes or brackets.
- 11. Isolate core and coil from enclosure, using vibration-absorbing mounts.
- 12. Nameplate: Include connection data and overload capacity based on rated allowable temperature rise.

B. Branch Circuit Panelboards

- 1. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- 2. Enclosure: NEMA PB 1; Type 3R conforming to NEMA 250.
- 3. Cabinet Size: As shown on manufacturer's drawings.
- 4. Cabinet Front: Hinged cover with paddle lock hinge.
- 5. Provide an integrated unit with transformer. Finish in manufacturer's standard gray enamel.
- 6. Provide panelboards with copper bus, ratings as scheduled on drawings. Provide copper ground bus in each panelboard.
- 7. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical.

8. Molded Case Circuit Breakers: NEMA AB 1; plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, rated for 75 degrees C copper conductors. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where required. Provide 20 percent spare breakers installed in the panelboard.

### PART 3 EXECUTION

#### 3.1 ERECTION/INSTALLATION/APPLICATION

- A. Install transformer/panelboards in accordance with NEMA PB 1.1.
- B. Install plumb, and in accordance with manufacturer's instructions, and as indicated on contract drawings.
- C. Height: 6 feet, 6 inches to top of transformer section.
- D. Provide grounding connections in accordance with Section 16170.
- E. Provide filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- G. Provide engraved plastic nameplates identifying transformer/panelboard equipment number.
- H. After initial energizing of transformers, measure the secondary voltage and adjust to nominal voltage by changing taps.

#### 3.2 QUALITY CONTROL

- A. Test according to general requirements of Section 16050 and to the relevant requirements of NETA ATS.

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- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, grounding, and conformance of installation to contract documents and manufacturer's instructions. Check tightness of wiring and mounting connections for circuit breakers and transformer prior to energizing.
- 
- C. ~~Record primary and secondary voltages; submit to FDF.~~
- D. Measure steady state load currents at each panelboard feeder. Rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION



SECTION 16470  
PANELBOARDS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Power panelboards.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Electrical Manufacturers Association (NEMA):  
1. NEMA AB 1-93 Molded Case Circuit Breakers and Molded Case Switches.  
2. NEMA PB 1-90 Panelboards.  
3. NEMA PB 1.1-91 General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.  
4. NEMA 250-91 Enclosures for Electrical Equipment (1000 Volts Maximum).  
  
B. InterNational Electrical Testing Association (NETA):  
1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

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- C. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
- D. Underwriters Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directories-95.

#### 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011.

#### 1.6 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

#### 1.7 PROJECT CONDITIONS

- A. Project Record Documents:
  - 1. Record actual locations of products; indicate actual branch circuit arrangement.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Siemens.
- B. Westinghouse.
- C. Square D.

#### 2.2 EQUIPMENT

- A. Circuit Breaker Panelboards:
  - 1. Circuit Breaker Panelboards: NEMA PB 1, circuit breaker type.

2. Panelboard Bus: Copper, ratings as indicated on contract drawings. Provide copper ground bus in each panelboard. Incoming bus shall have lugs suitable for cables indicated.
3. Minimum Integrated Short Circuit Rating: 18,000 amperes rms symmetrical, or as indicated on contract drawings.
4. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type, thermal magnetic trip circuit breakers with common trip handle for all poles, lockable using external devices. Provide UL-listed circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Breakers shall have lugs suitable for cables indicated.
5. Enclosure: NEMA 250, Type 12 (indoor) or Type 3R (outdoor).
6. Cabinet Box: 6 inches deep; 20 inches wide.
7. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, and flush lock, keyed alike. Finish in manufacturer's standard gray enamel.

### **PART 3 EXECUTION**

#### **3.1 ERECTION/INSTALLATION/APPLICATION**

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards horizontal and plumb. Install in accordance with manufacturer's instructions.
- C. Height: 6 feet to top of panelboard.
- D. Install panelboards as indicated on contract drawings.
- E. Provide filler plates for unused spaces in switchboards and panelboards.

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- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
  - G. Provide engraved plastic nameplates.
  - H. Provide working clearance in accordance with NFPA 70, minimum 36 inches from front.
- 

### 3.2 QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits. Submit recordings of steady load currents after balancing.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.
- C. Inspect and test accordance with NETA ATS except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

END OF SECTION

SECTION 16500  
LIGHTING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Luminaires and lampholders.
- B. Ballasts.
- C. Lamps.
- D. Exit signs.
- E. Emergency lighting units.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.
- C. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
  - 2. NFPA 101-94 Code for Safety to Life from Fire in Buildings and Structures.
- B. National Electrical Manufacturer's Association (NEMA):
  - 1. NEMA WD 6-88 Wiring Devices - Dimensional Requirements.

- C. American National Standards Institute (ANSI):
  - 1. ANSI C82.4-92 Ballasts for High Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).
- D. Underwriters Laboratories, Inc. (UL):
  - 1. ~~Electrical Construction Materials Directory--1995~~

## 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Product Data: Provide dimensions, ratings, and performance data including photometric and beamspread plots.

## 1.6 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Products shall be listed in the UL Electrical Construction Materials Directory, for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

- A. Luminaries
  - 1. Furnish high pressure sodium fixtures as indicated on drawings.
  - 2. Factory install ballasts, lamps, and accessories.
  - 3. Pendant luminaries: Provide swivel hangers, pendant rods, tubes, and chains as required to install luminaries at appropriate height.
- B. Exit Signs
  - 1. Description: LED type exit sign fixture suitable for use as emergency lighting unit.

2. Housing: Extruded aluminum.
3. Face: Translucent face with red letters on white background.
4. Directional Arrows: Universal type for field adjustment.
5. Mounting: Universal for field selection.
6. Battery: 6 volt, nickel-cadmium type, with 1.5 hour capacity.
7. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within 12 hours.
8. Input Voltage: 120 volts, 60 Hz.

C. Emergency Lighting Units

1. Description: Self-contained emergency lighting unit with rechargeable battery.
2. Input voltage: 120 volts.
3. Battery: Nickel-cadmium type with 1.5 hour capacity.
4. Battery Charger: Dual rate type capable of recharging discharged battery to full charge within 12 hours.
5. Lamps: 12 watt, sealed-beam type.
6. Electrical connection: 6-foot cord with NEMA WD 6-type 5-15 plug cap.

## 2.2 ACCESSORIES

A. Ballasts

1. High Intensity Discharge (HID) Ballast:
  - a. Description: ANSI C82.4 HID lamp ballast.
  - b. Description: HID lamp ballast.
  - c. Provide ballast suitable for lamp specified.
  - d. Voltage: Match luminaire voltage.

B. Lamps

1. High-Pressure Sodium Lamps: Clear, suitable for ballast, furnished in luminaire, and for burning positions.

C. Photoelectric Control

1. Control above maximum footcandles: provide with adjustable cutoff point.

2. Load control: Sized for fixture, 120 volts.
3. Provide photoelectric controls for exterior lighting.

### **PART 3 EXECUTION**

#### **3.1 SITE CONDITIONS**

- A. Examine substrate and supporting grids for luminaries.
- B. Examine each luminaire to determine suitability for lamps specified.

#### **3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install suspended luminaries and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at height indicated on drawings.
- C. Support luminaries independent of ceiling framing.
- D. Install surface-mounted luminaries and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

#### **3.3 QUALITY CONTROL**

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation according to project documents and manufacturer's instructions.

#### **3.4 ADJUSTING**

- A. Adjust exit sign directional arrows.
- B. Relamp luminaries that have failed lamps at substantial completion.



**3.5 CLEANING**

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

**3.6 DEMONSTRATION**

- A. Provide minimum of 2 hours demonstration of luminaire operation.

**END OF SECTION**

SECTION 16855  
HEATING CABLES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Heating cable and accessories.

**1.2 RELATED SECTIONS**

- A. Section 01000 - General Requirements.
- B. Section 01011 - Submittals Listing.
- C. Section 15060 - Pipe, Fittings, Valves, and Accessories.
- D. Section 15250 - Insulation.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
- B. National Electrical Manufacturers Association (NEMA):
  - 1. NEMA ICS 6-93 Industrial Controls and Systems Enclosures.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Annotated drawings reflecting installed features requiring freeze protection, for approval.

- C. Record Drawings: Submit after installation and testing of freeze protection equipment and materials.

**1.6 SYSTEM DESCRIPTION**

- A. Heat tracing for pipe and any other outdoor equipment requiring freeze protection with outside temperature at -10 degrees F. Pipes to be protected are indicated on contract P&ID drawings. Work includes design of heat trace system as well as products and execution herein specified.

**1.7 QUALITY ASSURANCE PROGRAM**

- A. Manufacturer: Company specializing in manufacturing the products specified in this section, with minimum 3 years experience.

**1.8 SEQUENCING AND SCHEDULING**

- A. Coordinate installation of heating cable with installation of piping and piping insulation.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers:
1. Raychem.
  2. Chromalox.
  3. Thermon.

**2.2 MATERIALS**

- A. Heating Cable
1. Self-limiting, parallel resistance electric tracing cable with grounding shield around conductors. Maximum output temperature 150 degrees F.
  2. Rating: 120 V or as required.

## 2.3 ACCESSORIES

- A. Thermostat: Type 4X according to NEMA ICS 6, adjustable setpoint, suitable for -30 degrees F to 140 degrees F.
- B. Power termination kits, splice kits, tee kits, and end seals supplied by heating cable manufacturer and suitable for use with the heating cable provided shall be utilized.
- C. Provide stainless steel identification tags for all devices. Include assembly and circuit numbers.

## PART 3 EXECUTION

### 3.1 SITE CONDITIONS

- A. Verify that the piping system is complete, tested, and ready for heating equipment.
- B. Verify field measurements shown on drawings. Where installation differs from drawings, annotate drawings and submit for approval before installation.
- C. Verify that required utilities are available, in proper locations, and ready for use.

- D. Follow these guidelines for cable wattage and maximum circuit length, or provide Supplier information to support alternate lengths:

Pipe OD	Cable Wattage	Max. Length, ft. (20 A, 120 V)	Max. Length, ft. (30 A, 120 V)
1-1/2 inch or less	3 watts/ft	265	330
1-1/2 to 3 inch	5 watts/ft	185	270
3 inch to 6 inch	8 watts/ft	130	200
8 inch	10 watts/ft	105	160
10 inch	15 watts/ft	80	120
12 inch	15 watts/ft	80	120

### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Install heat trace material on piping system as indicated on drawings. Install to allow for heat trace cable to be moved aside during maintenance of piping system.
- B. Install in accordance with manufacturer's instructions and NFPA 70. Serve cable circuits from GFCI circuit breakers as manufacturer's instructions and NFPA require for the use.
- C. Avoid pinching and making sharp bends in cable.
- D. Prevent damage by sharp objects during installation.
- E. Do not install electric tracing cables across expansion joints.
- F. Electric heat trace cables shall be installed in the 7 and 8 o'clock positions or in the 4 and 5 o'clock positions on horizontal runs of pipes.

- G. Accurately record actual locations of heating cable, thermostats, and branch circuit connections.

### 3.3 FIELD QUALITY ASSURANCE

- A. Test continuity of heating cable.
- B. Measure insulation resistance to manufacturer's recommended values. Use test instruments in accordance with manufacturer's instructions.
- C. Perform continuity and insulation resistance test on completed cable installation prior to installation of thermal insulation.

### 3.4 DEMONSTRATION

- A. Demonstrate operation of heating cable controls.

### 3.5 RECORD DRAWINGS

- A. Provide drawings showing actual heating cable installation. Include cable lengths, cable catalog numbers, indicating lights, and other similar details.

END OF SECTION